# ENERGY OPERATIONAL COMMITTEE

# FINAL REPORT

## November 12, 2010

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**Appendices**

# Introduction

Governor Bob McDonnell established an Operational Review Task Force in the Fall of 2010 to explore potential cost saving efficiencies in state government operations, particularly ones that are common to multiple agencies. Twelve areas were identified for review. This report addresses one of the twelve government operations - energy management. Because a similar study was conducted in 2007, the information that follows is a progress report on those recommendations, plus additional strategies to reduce consumption and state spending. (see Appendix 1 for 2007 Report)

The Operational Review Task Force Energy subgroup members included:

- State Sponsor – Stephen Walz, Director, Department of Mines, Minerals and Energy
- Private Sector – Michael Hubbard, Manager, Energy Conservation, Dominion
- Local Government – John Morrill, Energy Manager, Arlington County
- Agency Staff – Rachel Fowlkes, Director, Southwest Virginia Higher Education Center

Tommy Thompson, Energy Manager, Department of Mines, Minerals and Energy, contributed significant data and best practice examples for the report.

The Energy Operational Review team examined the following:

- Total spent on energy
- Implementation of 2007 Recommendations
- Best Practices for Energy Management and Efficiency
- 2010 Recommendations
- Recommended reasonable levels of consumption
- Potential cost savings

To accomplish this review, the Energy Operations Team looked primarily at Executive Branch agencies. Institutions of higher education were not included in the formal review, although many of the 2010 recommendations are applicable to higher education institutions as well as local governments. It should be noted that several of the best practices originated within the Commonwealth's colleges and universities.

The Energy Operations Team suggests that prior to implementation of the 2010 recommended actions, an additional analysis be conducted by an internal task force of state agency managers.

# I. State Government Total Spend for Energy

In FY2010, the Commonwealth of Virginia executive branch agencies spent $85.9 million for energy to operate its facilities, exclusive of transportation. This was an 8.5% decrease from FY 2009 in which energy costs were $93.8 million. As illustrated in the table and chart below, electricity accounts for 70% of all energy costs. Energy expenditures increased dramatically from FY 2007 through FY 2010. This is attributed to a number of factors including:

- Increases in electricity prices; and
- Energy required to heat and cool new state buildings and leased space.
- Note that fluctuating weather conditions may result in higher costs in any single year.

Even though total dollars spent increased, cost of energy decreased in various agencies as a result of:

- Implementation of energy efficiency improvements;
- Decreases in unit costs of natural gas, fuel oil, and coal in FY10, and
- Fluctuating weather conditions which may result in lower costs in any single year.

Bottom line: **Reducing electrical consumption is the #1 priority for containing energy costs in state owned and leased facilities.**

*Higher education institutions spent $200.1 million for energy in FY 2010 which is an 8.8% decrease from $219.3 million spent in FY 2009. While this operational review is not directly addressing higher education energy costs, data on higher education energy costs and total state government energy costs are provided as a basis to compare with the 2007 report.

It is important to note that data reporting inconsistencies among institutions make it difficult to accurately identify total energy spend. For example, some colleges and universities charge departments and enterprise activities for energy use. As a result, energy costs may be reported twice, once when the institution originally purchases the energy and again when the department or enterprise activity pays the central facilities department for the energy. Additionally, because some higher education institutions did not report energy costs during FY 2008, the data is incomplete and consequently invalid for comparative analyses.

The table and chart on page 4 profile energy expenditures by cost, but not by units of consumption (gallons heating oil, kWh of electricity, etc). The cost data were taken from the Commonwealth's central accounting system (CARS). Data are only as accurate as entered by individual agencies in CARS. Additional information, including the amount spent for other fuels, is provided in Appendix 2. Agency or institution specific data is available from the Department of Mines, Minerals and Energy.

As the Energy Operation Team collected date for this report, shortcomings in the State's data system quickly became evident. Unfortunately, no data systems is in place to comprehensively account for energy consumption across all agencies by units of energy, nor other critical variables such as the size and age of the facility's conditioned space or the agency's functions (i.e., office space, prison, garage). These shortcomings will be addressed in the recommendations.

**Virginia State Agency and Institution Facility Energy Cost - FY 2002 - 2010**

| | Coal | Gas | Oil | Steam | Wood Fuels | Electrical Service Charges | Total |
|---|---|---|---|---|---|---|---|
| **Executive Branch Agencies** | | | | | | | |
| FY 2010 | $1,264,630 | $15,652,994 | $6,523,532 | $1,602,869 | $417,994 | $60,424,124 | $85,886,143 |
| FY 2009 | $2,549,665 | $19,721,729 | $7,118,151 | $1,853,018 | $322,395 | $62,232,801 | $93,797,759 |
| FY 2008 | $1,262,149 | $19,375,706 | $8,655,260 | $1,661,563 | $238,679 | $51,959,957 | $83,153,314 |
| **Higher Education** | | | | | | | |
| FY 2010 | $9,044,732 | $32,977,925 | $3,576,880 | $11,882,504 | $293,220 | $142,327,010 | $200,102,270 |
| FY 2009 | $10,142,594 | $49,962,517 | $5,001,667 | $11,446,997 | $293,499 | $142,478,198 | $219,325,471 |
| FY 2008* | $9,969 | $25,785,328 | $1,451,592 | $7,612,092 | $231,204 | $43,713,802 | $78,803,986 |
| **Combined Total** | | | | | | | |
| FY 2010 | $10,309,362 | $48,630,919 | $10,100,412 | $13,485,372 | $711,214 | $202,751,134 | $285,988,414 |
| FY 2009 | $12,692,258 | $69,684,246 | $12,119,818 | $13,300,016 | $615,894 | $204,710,999 | $313,123,231 |
| FY 2008* | $1,272,118 | $45,161,034 | $10,106,853 | $9,273,655 | $469,882 | $95,673,759 | $161,957,300 |
| FY 2007 | $6,779,842 | $60,765,473 | $10,759,529 | $10,731,780 | $412,902 | $150,056,591 | $239,506,118 |
| FY 2006 | $6,067,624 | $65,549,888 | $14,104,367 | $13,473,297 | $426,177 | $143,502,979 | $243,124,331 |
| FY 2005 | $5,700,212 | $49,226,444 | $10,541,216 | $7,387,113 | $384,030 | $134,739,219 | $207,978,233 |
| FY 2004 | $4,558,747 | $39,314,281 | $8,109,102 | $6,571,215 | $338,827 | $125,817,958 | $184,710,130 |
| FY 2003 | $4,247,158 | $33,610,413 | $7,641,546 | $4,308,555 | $285,033 | $125,875,819 | $175,968,523 |
| FY 2002 | $4,415,295 | $24,932,681 | $4,282,159 | $4,516,517 | $363,580 | $123,071,071 | $161,581,303 |

*Description*

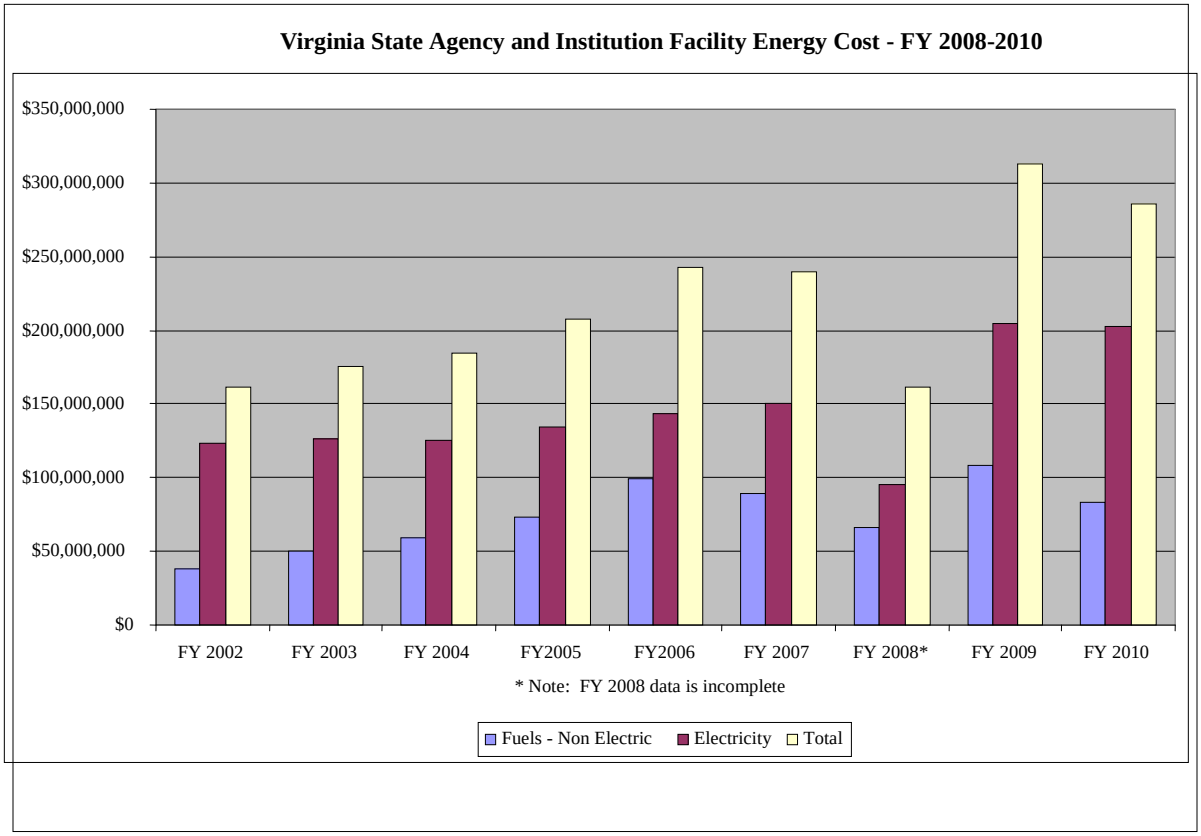
1321, Coal: Include expenditures for coal or coke consumed in transportation, heating, and/or power generating plants. Include the cost of transporting the coal.
1322, Gas: Include expenditures for natural and manufactured gas consumed for cooking, heating, power generating plants, and laboratories.
1324, Oil: Include expenditures for fuel oil, oil, and oil derivatives consumed in heating, and/or power generating plants. Include the cost of transporting the oil.

1325, Steam: Include expenditures for steam consumed in heating and/or power generating plants purchased from a second party.

1326, Wood Fuels: Include expenditures for wood products used for fuel for heating and power generating plants, to include such items as round wood, chips, sawdust, and bark. Include transportation costs.

1542, Electrical Service Charges: Include expenditures for electricity.

* Note: FY 2008 data for higher education institutions are incomplete and low. This should not be used for annual comparison purposes.




# II. Implementation Progress of 2007 Recommendations

The 2007 Energy Operational Review Report included eight recommendations for best practices in state energy management:

1. Create a Virginia Energy Management Program (VEMP)
2. Aggregate Procurement of Natural Gas
3. Establish a Commissioning/Recommissioning Pilot for State-Owned Buildings
4. Automate Utility Billing
5. Self-fund Energy Efficiency Projects with a State Revolving Fund
6. Establish a State Facility Demand Response Program
7. Encourage Telework and Use of Mass Transportation
8. Provide for agency participation in the Virginia Environmental Excellence Program

### 1. Create a Virginia Energy Management Program (VEMP)

This recommendation has been substantially implemented. The Department of Mines, Minerals and Energy established the Virginia Energy Management Program (VEMP) to provide overall direction, contracting, technical assistance, and operations of the state facilities energy management program.

Six people serve state agencies through the VEMP. They include:

| Position | Name |
|---|---|
| Manager | Tommy Thompson* |
| Performance Contracting (State Facilities) | Charlie Barksdale |
| Performance Contracting (Local Govt.) | Dan Acker |
| Energy Contracts | Bob Parolisi |
| Demand Response | Walid Daniel |
| Fuels Administrator | Eileen Carson* |

**position also completes non-VEMP duties*

Although the Fuels Administrator was not recommended in the 2007 Operational Review, the position was established to address issues with natural gas procurement and the difficulty agencies had in reconciling the quantity of gas provided to the city gate by the marketer and the quantity of gas delivered to the burner-tip by the Local Distribution Company (LDC).

The VEMP has implemented one of the largest energy-savings performance contracting (ESPC) programs of any state. Establish prior to the 2007 Operational Review, the ESPC program is a cooperative effort involving DMME, the Department of General Services, the Treasury Board and Department of the Treasury, and the Department of Planning and Budget. Through a streamlined process of contracting, technical assistance, and funding participating state agencies and institutions are able to upgrade HVAC systems, lighting, and other utilities to new energy efficiency standards. ESPC investments have totaled $228 million (see Appendix 3), leading to a projected total cost avoidance of approximately $13.6 million per year. These savings are used to pay back borrowed funds needed to capitalize the work. After the financing is repaid the savings are available to the agency. There are currently (November, 2010) an additional 10 projects in planning with an approximate value of $50 million.

Using federal ARRA funding, DMME has been able to expand ESPC support services to local governments and school systems across the Commonwealth.

Governor McDonnell's Executive Order 19, issued on July 1, 2010, reinforces the work of the VEMP program. Executive Order 19 sets a goal for agencies to reduce FY 2010 energy use by at least 5 percent by FY 2012. The Executive Order requires other energy management practices such as building or renovating buildings to meet LEED silver or Green Globes two-globe standards; purchasing Energy STAR equipment; operating heating and cooling equipment efficiently to reduce energy use, and turning equipment off when use is not required.

The 2007 Operational Review also recommended the creation of a VEMP position to provide training and facilitate communication among state agency energy managers and all employees. Unfortunately, funding was not provided to implement this recommendation.

### 2. Aggregated Procurement of Natural Gas for State Agencies

This recommendation has been partially implemented. Under DMME's contract with Compass Energy, DMME has aggregated natural gas purchases for large state users and approximately 160 small accounts in state facilities served by Columbia Gas of Virginia. Working with these agencies DMME has defined their natural gas requirements and fixed the cost of natural gas for these facilities. Their cost has been set at $5.15/decatherm for FY 2011 and $5.00/decatherm for FY2012. It should be noted that total natural gas cost includes on average $1.20/decatherm added to the base price for delivery to the end using facilities (i.e., transmission and distribution pipelines). The amount charged for transmission and distribution can vary greatly from the average for any single distribution utility.

This program focuses on achieving three benefits for agencies:

- Providing budget certainty;
- Minimizing risk, both supply and financial; and
- Obtaining the best possible price.

Currently the only data available for this program is a comparison of the aggregated prices versus those charged by local natural gas distribution companies (LDC). The LDC is the default provider of gas to all accounts. Given that the program is in the early stages of implementation no comparison is available at this time.

### 3. Establish a Commissioning/Recommissioning Pilot for State-Owned Buildings

Recommissioning, also called retrocommissioning offers building owners a systematic process for evaluating major energy-consuming systems and identifying opportunities to optimize equipment operation. Once issues are identified, retrocommissioning tunes up existing building energy efficiency and operational procedures and controls.

This recommendation has been partially implemented. While no central funding was provided for building recommissioning, the Department of General Services (DGS), using a $195,000 grant from DMME, is undertaking a pilot recommissioning project for the James Madison building in Richmond. Since the project is currently underway, it is too early to quantify any results. However, initial reports are promising.

According to a study by Lawrence Berkeley National Laboratory, retrocommissioining yields an average energy reduction of approximately 16%, with savings typically coming from resetting existing controls to reduce HVAC waste while maintaining or increasing comfort for occupants. Assuming 16% savings for a typical 15,000 square foot office building, approximately $4,900

could be realized annually. Retrocommissioning can be completed every 3 to 5 years with a positive result in energy savings.

### 4. Implement Automated Utility Billing

The 2007 Report emphasized the need to establish a common automated utility billing system in order to track consumption and expenditures across agencies and institutions. Included in the program would be a tiered system of reports and data to help agency management, agency energy managers, and facility managers implement energy efficiencies. Unfortunately, this recommendation was not implemented due to the lack of funding.

Multiple vendors have offered to put utility data management systems in place with funding derived from a share of energy savings and fees. The Commonwealth has not moved forward due to the lack of personnel to manage implementation. Consequently, state government still cannot accurately monitor building energy performance across agencies and institutions using benchmarking and performance measurement tools.

The American Council for an Energy-Efficiency Economy (ACEEE) issued its 2010 State Energy Efficiency Scorecard in which it states "benchmarking takes building efficiency a step further by requiring that all buildings undergo an energy audit or have their energy performance tracked using a recognized tool such as U.S. Environmental Protection Agency (EPA) Energy Star Portfolio Manager. While many states have admirable voluntary benchmarking programs, … a binding requirement ensures a comprehensive set of data that can result in cost-effective energy efficiency investments."

As noted in the ACEEE Report, state facilities and operations offer a unique opportunity to lead by example by incorporating energy efficiency measures into state facilities to achieve energy cost savings. Reduction targets and benchmarking (via audits and tracking energy performance) can assist the state governments achieve energy savings.

### 5. Self-Fund Smaller Energy Efficiency Projects with a State Revolving Fund

A revolving loan program was recommended for projects too small for effective energy savings performance contracting. DMME established a pilot revolving loan fund. However, due to budget cuts, funding for the project was eliminated. The Commonwealth must make long term financial investments in energy efficiency projects if it is to achieve energy savings goals as mandated in EO-19. Future implementation is a question of investments and savings.

### 6. Establish a State Facility Demand Response Program

DMME is implementing this recommendation through use of an internal specialist and third party vendor. Participating agencies access the program by issuing a zero dollar purchase order and are paid for their participation by the vendor. The Commonwealth has one of the largest

aggregated demand response programs in the Mid-Atlantic region, if not the country. The report (Appendix 4) shows that the program is providing benefit in an economically challenging period where peak electrical utility loads can be reduced. Payments from this program will be changing over time as PJM, our regional transmission organization and administrator of the program, works to refine operations as required by the Federal Energy and Regulatory Commission (FERC). Participation in this program does incur an operational cost to participants and does require changes in the way buildings are operated. This program has the potential to bring several million dollars to agencies. This is a voluntary program and participation is an agency decision.

### 7. Encourage Telework and Use of Mass Transportation

This recommendation has been implemented. As provided in § 2.2-2817.1 of the *Code of Virginia,* each state agency is required to pursue a goal of not less than 20 percent of its eligible workforce telecommuting by January 1, 2010. This requirement is monitored through reports filed with the Secretary of Administration.

Executive Order 19 also provides that if travel is required for state business, car pooling should be employed whenever possible. The EO-19 also provides agencies with an option to establish policies prohibiting reimbursement for single-passenger use of personal vehicles for business travel if such use is avoidable, and that agency policies should encourage the use of public transportation and other alternatives to personal vehicle use.

Many state agencies offer transit assistance programs that pay a portion or all of transit costs for employees. These programs reduce cars on the road during rush hours, benefiting both participants and non-participants.

### 8. Agencies Should Participate in the Virginia Environmental Excellence Program.

This recommendation has been partially implemented. The Department of Environmental Quality operates the Virginia Environmental Excellence Program. This program is set up on a facility by facility basis. As of November, 2010, 118 state facilities were participating or are pending review in the program.

# Best Practices for Energy Management and Efficiency

**Best Practices for Energy Management Programs**

The American Council for an Energy Efficient Economy published The 2010 State Energy Efficiency Scorecard (ACEEE Report) in October 2010. The ACEEE Report lists specific actions that states are taking to encourage conservation and efficiency. Likewise, the ACEEE

Report and online database contain information about what individual states are doing to "lead by example," including annual appropriations for energy management. According to the Report, states increased total funding for energy efficiency from $2.5 billion in FY2007 to $4.3 billion in FY2009.

The ACEEE report references the EPA's "Lead by Example Guide," which highlights what states and other local jurisdictions are doing, as well as the resources that are available to implement Lead by Example programs. Included are six key Lead by Example recommendations:

1) Improve efficiency in government facilities
2) Integrate energy efficiency and renewable energy measures in green buildings
3) Procure energy-efficient products
4) Purchase green power
5) Use clean energy supply technologies
6) Other programs (demand-response, water efficiency, etc.).

Additionally, EPA's Building Upgrade Manual provides a comprehensive reference for new construction, renovation, and facility maintenance. It addresses dozens of measures by categories (i.e., lighting, HVAC,). Although office facilities are covered extensively in the main body of the manual, recommendations for other building types are reviewed in the manual's Appendices. Numerous other energy management resources are available through EPA. Among them are the following:

1) ENERGY STAR Portfolio Energy Manager enables states to rate their facilities' energy performance and identify opportunities for improvement. Facilities scoring 75 or higher can apply for ENERGY STAR recognition.

2) ENERGY STAR Target Finder allows states to assess the design of new buildings and compare simulations with existing buildings.

3) ENERGY STAR Small Business Calculator estimates a facility's energy intensity and potential energy cost savings from upgrades.

4) National Institute of Standards/Technology Life-Cycle Cost Program enables states to evaluate alternative designs that may have higher initial costs, using a life-cycle costing method.

According to EPA's *Lead By Example* data, states that improved energy efficiency in government facilities decreased energy consumption by 35% in existing facilities, and 50% in new and renovated buildings. The ACEEE Report states that these investments reduced energy costs and increased building value. EPA estimates that for every $1 spent on improved energy efficiency, the building's value increases proportionately by $2 to $3. Moreover, incorporating green energy design (i.e., ENERGY STAR, LEED) and products into new buildings can reduce energy costs by as much as 50% when compared to conventional construction.

EPA recommends the following key steps for building a successful *Lead By Example* program:

1) Build a strong *Lead by Example* team, including a range of expertise and perspectives within the state government agencies. Also, partnering with outside state government entities can provide valuable input to implementation and championing efforts in the community.

2) Secure a high-level of support, including top-level leadership and *Lead by Example* team members with access to key decision makers. Build and maintain support with policymakers. Continue to articulate the value of the program.

3) Establish goals that are clear and quantifiable.

4) Develop an energy baseline to assist in measuring goal attainment. The baseline should account for actual past, current state and projected energy consumption.

5) Screen *Lead by Example* options based on energy savings and other criteria. The screening criteria should include expected energy savings, financial issues such as payback periods and life-cycle costs, environmental benefits, economic benefits, visibility and feasibility.

6) Implement a systematic approach to energy efficiency. The ENERGY STAR Guidelines for Energy Management provides a systematic approach to implementing energy efficiency. The measures are ideal for a portfolio of government buildings. Pilots can be applied for measures to be compared to.

7) Take advantage of available financing mechanisms. It is helpful to use multiple financing options (e.g. municipal least-purchase agreements, revolving loan funds, aggregated purchases, performance contracting).

8) Conduct communication and outreach initiatives to ensure the benefits are known and supported.

9) Learn from local, state and federal sources.

10) Evaluate report on, and update the Lead by Example program.

Executive Order 19 requires agencies to turn off energy systems when not needed, and adjust building conditioning for energy savings. E Source LLC has determined that lights utilized approximately 39% of the electricity in office buildings. Strategies that managing and control lighting can yield significant savings.

Adjusting the settings to the HVAC systems can yield significant savings. The use of programmable equipment to adjust temperatures when buildings are not occupied is a key strategy to conserve energy. Additionally, small setbacks (0.5°F 1.0°F) during working hours further reduce energy expenditures.

Office equipment should follow a similar strategy. According to national research, a typical desktop computer can use up to 140 watts of power while sitting idle. A single monitor that draws 70 watts left on overnight and on weekends can add over $50 to an annual power bill. Smart power strips with built in occupancy sensors can assist in conservation efforts. Low-power sleep modes in newer electronic devices should be fully utilized when these items are not in use.

Proper cleaning and maintenance is included as a best management practice for energy savings. For example, a licensed technician should be checking, cleaning, calibrating and lubricating HVAC systems including outside air dampers and economizers. If not regularly and systematically checked, an economizer can get stuck in the fully open position, drawing into the building excess fresh air and humidity. These malfunctions can increase annual energy bills as much as 50%. Newer, inexpensive economizer sensors can be purchased to reduce annual cooling energy by up to 8%.

*The Rapid Deployment Energy Efficiency Toolkit (RDEE)* was developed under the guidance of and with input from the Leadership Group of the National Action Plan for Energy Efficiency, with support from EPA and the U.S. Department of Energy (DOE). It was designed to help state and local authorities plan and implement successful program as they advance energy efficiency through the American Recovery and Reinvestment Act of 2009 (ARRA). Among many best practices highlighted in the RDEE report, the use of cool roofs was cited as an opportunity to reduce energy costs. When a roof area needs recoating or painting, some corporations are opting to use white or another highly reflective color to minimize the amount of heat the building absorbs. A study referenced by E Source indicates that using reflective paint can reduce peak cooling demand by 15 to 20%. ENERGY STAR Roofing Calculator can assist customers on how much can be saved by utilizing this energy efficiency measure.

Loudoun County Schools was named a 2010 Energy Star Partner of the Year for their consistent benchmarking efforts through Portfolio Manager and resulting achievement of 37 Energy Star-labeled schools. Staff in Loudoun found that once some schools became Energy Star-labeled, principals and staff at others quickly wanted to know what they needed to do to earn it for their own schools.

The City of Virginia Beach uses Portfolio Manager to track its energy consumption, including its Convention Center, which scored well enough to achieve LEED-EB. Staff can benchmark their energy intensity with other convention centers around the country.

Arlington County uses Portfolio Manager for benchmarking, and posts on its website the energy consumption, energy intensity, and carbon footprint of each County government building with comparison to similar buildings. Beginning in 2011, Arlington will post building performance labels in its government buildings to provide transparency on energy management.

A Master Account has been established for Virginia localities to share energy consumption from government and school buildings, to enable peer comparisons and exchange of best practices among various jurisdictions. The Master Account will enable weather-adjusted comparisons of performance of fire stations, libraries, community centers, jails, and other government buildings between localities. This effort was begun in summer 2010.

Fairfax County uses a third party vendor to receive and pay all natural gas and electric bills from a central energy fund at the County finance office. Funds are drawn from each individual agency's utility budget. The County tracks bills in EnergyCAP. They plan to add propane, water, and fuel oil in the future.

The Connecticut Office of Policy and Management ("COPM") administers a demand response program for eleven state agencies. COPM works with the participating agencies to reduce peak electrical demand by transferring loads to distributed generation equipment and reducing non-essential loads. These actions assist ISO New England, the regional grid operator, to avoid installing additional infrastructure to meet demand. For these actions, the ISO provides COPM approximately $300,000 quarterly. This payment is then allocated back to the participating state agencies for reinvestment in clean energy products.

# 2010 Recommendations for State Government Energy Management

The Energy Operational Review Team carefully reviewed implementation of the 2007 Report along with current best practices in energy management. The team recommends that the Commonwealth continue to support the 2007 recommendations, and adopt the following four additional recommendations. We acknowledge that all of the recommendations need additional analysis and funding before they can be fully implemented. We recommend that an internal task-force of state agency managers, led by the DMME VEMP program, be established for this purpose.

It should be duly noted that the Energy Operational Review Team State investigated best practices in the private sector. Turning off lights and computers when not in use, programming thermostats, and similar measures are common in government and for profit organizations. However, state and local governments face another challenge in adopting private sector best practices. Businesses have a profit objective. Reducing energy consumption and expenditures increase profits, and return on investment for energy upgrades. Given the service or regulatory mission of government agencies (i.e., mental health, corrections, mine safely), budget decisions are addressed differently. For example when the Department of Mines, Minerals and Energy was required to reduce its General Fund budget, various options were considered such as cutting the VEMP Training Coordinator position verses a Mine Inspector. Because the Department's

core mission is mine safety, the VEMP Training Position was eliminated. It is likely that similar decisions have been made by other agencies in order to support core missions.

Another factor affecting implementation of energy efficiencies is that energy costs are a relatively small percentage of each individual agency's budget. Consequently, agencies may be less motivated or capable of developing successful energy efficiency projects.

Aggregating energy costs across all agencies results in a large, attention-getting number ($286 million in FY 2010). Likewise, aggregating savings across all agencies can be a powerful incentive to help state facilities and institutions meet the 5%, $14 million reduction mandated in Executive Order 19.

1. **Centralized Energy Management Across State Facilities**

The State of Missouri, as outlined in case study by Frost and Sullivan (see Appendix 5), shows the benefit of a centralized approach to energy management. This project had a Return on Investment (ROI) in less than 2 years of approximately 40%. With the work that has already been done in Virginia state facilities (i.e., Energy Savings Contracts), it is unlikely that the Commonwealth would achieve the same level of savings but, the case study gives an example of what is possible with a more centralized approach to facility management.

The state of Maryland DGS Utility Bill project is one component of their program to reduce energy consumption by 15%. Using a centralized management system for all state facilities, Maryland efficiently monitors energy cost and consumption (Appendix 6).

2. **Convert Virginia Energy Management Program (VEMP) to an Enterprise Operation**

Currently, cost savings generated from the work provided by the Energy Management Program positions revert back to participating agencies. A portion of these savings could be used to fund the VEMP as an enterprise operation. As an enterprise operation, energy would not compete in agency budgets with core mission priorities. Money derived from agency's energy accounts would support VEMP recommendations that cannot be implemented with fluctuating General Fund appropriations.

3. **Centralize Responsibility for Energy Management and Investments**

Energy expenditures at each agency are a small part of the agency budget, but across all agencies energy is a large expenditure. By giving one agency, such as the DMME VEMP program, responsibility for the state energy budget, together with authority and responsibility for achieving energy efficiency goals, energy would become a core mission and would receive the support necessary to be successful. Additionally, with sufficient budget flexibility to move funds from energy bills to energy improvements, projects with a Return on Investment (ROI) of less than one year could be funded immediately.

The VEMP could also implement a centralized energy data management system. This could be proposed under the Private Education Facilities and Infrastructure Act of 2002 (PPEA). However, the VEMP does not have sufficient staff resources at this time to implement this recommendation. Additional staff would be required to implement and achieve the value available through such a system.

4. **Develop a mechanism which allows agencies to more effectively communicate with each other on energy initiatives**

The energy operational review subgroup asked agency energy managers what actions they are taking to improve energy efficiency and received an impressive list of accomplishments. Sharing successes and failures across agency boundaries could improve operations across the Commonwealth through lessons learned, both positive and negative.

Although communication occurs informally and through an annual energy contract management meeting hosted by DMME, communication of best practices is typically limited to agency energy managers. Future training and communication opportunities might include an Energy Expo that travels to various regional locations across the Commonwealth where vendors, businesses, schools and colleges, and agencies can showcase best practices while learning about new energy products, sources of alternative/green energy, conservation practices, recycling, net metering, etc.

An important part of a communication strategy would be to educate state employees how their actions affect state energy use and costs. The VEMP could use employee education resources from the Federal Energy Management Program, local governments, and private businesses in this effort.

# III. Recommended Reasonable Level of Consumption

Defining a reasonable level of energy cost reductions is a difficult task given that most agencies have implemented multiple rounds of energy conservation measures. Any simple goal that would require an across the board reduction would put agencies that have made significant progress in energy efficiency at a disadvantage. Furthermore, comprehensive information is not available to determine reasonable target reductions in energy consumption by agency or facility.

An alternate approach would be to define a benchmark for energy consumption for building types and require buildings to meet the benchmark goals. This would put the responsibility for reducing costs and improving efficiency on those building managers and agencies that have not made acceptable progress in improving efficiency and lowering cost.

Implementing this type of target would require implementing a utility data management system as defined above, combined with building square footage information to give an energy

use/square foot for each building. This would allow a comparison of buildings in each type allowing higher energy using buildings to be targeted.

# IV. Potential Cost Savings

Executive Order 19, issued by Governor McDonnell in July, 2010, included a target that agencies should reduce energy use by 5% of FY 2010 amounts by FY 2012. A 5% reduction would lead to $4.3 million in lower energy costs for executive branch agencies (assuming a one-to-one relation between energy use and cost reductions), and over $9.5 million in lower energy costs for higher education institutions.

Note that not all of these cost reductions would be available for rebudgeting. Escalation of energy unit prices would require that that energy budgets grow even while energy consumption is reduced. The heart of this is issue is the difference between cost savings and cost avoidance. By reducing energy consumption, the state has a savings if energy prices remain constant and cost avoidance if energy prices increase.

# 2010 ENERGY STUDY - APPENDIX 1

## COMMONWEALTH OF VIRGINIA

## ENERGY OPERATIONAL COMMITTEE

## FINAL REPORT

**September 15, 2007**

**Foreword**

Inspired by the efforts of the Virginia General Assembly Cost Cutting Caucus (http://vacostcutting.blogspot.com/) and Executive Branch progress in formalizing and implementing performance management throughout the Commonwealth (www.vaperforms.virginia.gov), in February 2006 Governor Timothy M. Kaine, Chief-of-Staff William H. Leighty, Delegate Christopher B. Saxman and Senator Walter A. Stosch implemented the concept of Virginia state government "Operational Reviews." Co-chaired by members from the House of Delegates and Senate, and staffed by volunteer experts from the Executive Branch and private sector, each of these review teams focused on a single operational topic common to nearly every agency and institution in the Virginia state government -- specifically Energy, Fleet, Travel, Communications, Print, Mail, Solid Waste, Water, Return-to-Work and Receivables. The overall intent of each review was to develop recommendations for driving higher levels of state government performance and cost-effectiveness in its service to the citizens of Virginia. The method centered on the use of cross-boundary, collaborative teams of experts with a full appreciation of the need to improve performance across the state government enterprise.

Decisions to accept, revise or reject any recommendation presented in an Operational Review final report belong to the Operational Review Oversight Committee. This committee is currently comprised of Delegate Christopher B. Saxman (chair), Senator Emmett W. Hanger, Jr., and Secretary of Finance Jody M. Wagner. In all cases, the committee will base its decisions on the expertise and data provided in the reports in combination with expertise and data from other sources (including stakeholders) they believe to be relevant and of value to the issue(s). Their goal is to test, tune and advance the very best recommendations in an effort to improve Virginia state government performance in the most cost-effective way possible. Specific decisions to advance a recommendation are clearly subject to all applicable laws, policies and processes.

Looking forward, additional Operational Reviews may be initiated, as was recently the case for the topic of Staff Augmentation (use of temporary staff) across the Commonwealth. In all cases, new reviews must be justified to the Operational Review Oversight Committee by clearly articulating (1) the operational problem / opportunity, (2) its broad applicability across agencies, and (3) relevant data (including historical costs and performance or management difficulties) that further emphasize the need for improvement.

## Introduction

The Commonwealth of Virginia has completed an Operational Review of energy use within state government. The review assessed Energy Best Practices being used by private business, Virginia agencies, other states, the federal government, and the provisions of state energy management Executive Order 48 (2007) issued by Governor Kaine. The Committee is recommending best practice initiatives that should be implemented in the Commonwealth.

An Energy Operational Review Committee of legislative leaders and in-house subject matter experts was formed to lead the energy use operational review. Senator Emmett Hanger and Delegate Harvey Morgan provided overall direction to the study while a team of seven state employees representing energy-using agencies and institutions made up the study team.

To better understand existing state energy management practices, the Committee reviewed previous assessments, projects, and initiatives, conducted interviews with external subject matter experts, and conducted interviews with existing state agency energy managers. As a result, the Committee was able to (i) identify overall costs and cost drivers, (ii) identify past and current state government practices related to energy management, (iii) identify best practices that can be applied to the Commonwealth's operations, (iv) benchmark current performance against best practices, (v) identify how we can leverage our size as a customer in the energy marketplace, and (vi) develop recommendations on how to implement best practices.

The operational review also addressed non-energy state policies and practices such as leasing, parking, and commuting that affect energy use by state employees. In order to avoid duplication of work, the Committee reached agreement with other operational review teams, such as water usage, fleets, and real estate, about where overlapping issues will be assessed. For example, the fleet management review will address gasoline purchasing and dispensing activities and other energy-savings components of state fleet operations. This review addressed broader energy issues related to transportation such as the use of alternative fuels (E-85 and biodiesel).

Executive Order 48 (EO-48), *Energy Efficiency in State Government*, was issued while the Committee undertook this study. The Order incorporates several best practices that the Committee was considering. These include a requirement for an Agency Energy Manager in those agencies with energy costs exceeding $1 million; design and construction consistent with the energy performance standards of the U.S. Green Building Council's LEED rating system (including the use of Virginia forest products with alternate certification) or the United States Environmental Protection Agency/Department of Energy's "Energy Star" rating; to maximize biodiesel and ethanol use in state fleet vehicles; to lease space within a quarter mile of a bus, trolley, Metro or commuter rail stop; and to purchase ENERGY STAR rated appliances.

The Committee held 16 meetings with subject matter experts from the public and private sector to gain knowledge and expertise on energy best practices. Based on those discussions, the Committee developed a list of recommendations that are discussed in this report. This Committee believes these recommendations will lead to an implementation phase that should be

followed by an evaluation and revision process to optimize energy efficiency in state facility operations.

## Energy Costs and Cost Drivers

Virginia state agencies and institutions spent approximately $243 million in 2006 to operate their facilities. This has increased from approximately $162 million in 2002. This is an average 12% per year growth. Commonwealth agencies and institutions also spent nearly $74 million in 2006 to repair and maintain energy-using electrical and mechanical equipment. This increased from approximately $66 million in 2002, or by approximately 3% per year. Year-by-year energy costs in state facilities, as reported by the Department of Accounts (DOA), are provided in Appendix 1.

The largest cost driver is the increased commodity cost of energy. The largest commodity cost increase was in natural gas as a result of disruption of wells and transportation pipelines from the 2005 Gulf of Mexico hurricanes, competition for available gas by peaking electric generation units, and a decrease in total domestic gas production. We expect the commodity cost of energy to continue to increase for the foreseeable future. As an example, the fuel surcharge for Dominion Virginia Power accounts in FY 2008 will increase by approximately $8 million.

Another driver of increased energy cost is the growth in state building square footage. The Commonwealth inventory of buildings is increasing in size, requiring more energy.

The Commonwealth's inventory is also getting older, requiring increased repair and maintenance costs. It is estimated that repair and maintenance costs will continue to increase each year at the same relatively constant rate.

While not directly addressed in this operational review, the Commonwealth spent approximately $48 million in 2006 for gasoline and diesel fuel. This increased from $24 million in 2002, or by an average of 25% per year. Gasoline and diesel use concerns are being addressed in the fleet management operational review.

## Best Practices Being Used in State Facilities

A number of agencies and institutions within state government have aggressively pursued energy best practices. These provide a starting point for identifying best practices for use by all agencies and institutions.

1. Energy savings performance contracting is currently the most popular option for agencies to implement energy efficiency projects. Approximately 25 state agencies are taking advantage of energy savings performance contracting. As a result, over $110 million of energy savings actions are in process in state facilities. It is estimated that these projects will provide over $7 million in savings each year, resulting in a simple payback of about 14.4 years per project.

   Other agencies have used a mix of internal and external funds to implement energy savings actions. They have used maintenance reserve, capital funding, and funds from other sources for agency energy projects. The advantage of direct funding is that all cost savings realized from the upgrade are immediately available to the agency. Generally, agencies are able to implement relatively inexpensive, simple efficiency measures that are likely to pay for themselves in about a year using internal funds. When combined with external funding for longer-term projects, an agency can reduce the funds that must be borrowed and therefore retain a higher percentage of savings. The Virginia Community College System is a good example, using performance contracting across its 40 campuses combined with internal funds to supplement under-funded projects for a more comprehensive renovation of existing plant and equipment.

   DMME has one staff person who assists agencies with performance contracting. This assistance includes project development, back-of-the-envelope opportunity review, measurement and verification assistance, and identifying additional projects for energy savings. DMME is reaching out to agencies that do not currently have a performance contract in place. This type of support will provide additional savings to the Commonwealth in the future as more performance contracts are implemented.

2. Executive Order 54, *Energy Efficiency in State Government*, issued by former Governor Warner in 2003, directed state facilities to reduce their energy consumption by 10% by 2006 based on a 2002 baseline. In the Executive Order, DMME was required to report on agency progress toward meeting this goal. By 2006, 17 state agencies met or exceeded the 10% goal.

3. The Commonwealth is among the largest user of energy in the state. A best practice being used today is leveraging the buying power of the Commonwealth through state contracts for natural gas, heating oil, and for most of the electricity used in state facilities. These contracts provide energy to state facilities at rates that are at or below what most private businesses pay.

4. The Association of Physical Plant Administrators (APPA), which promotes best practices, is used by many of Virginia's higher education agencies to train personnel involved in energy management. APPA offers its Institute for Facilities Management course twice a year through which facility personnel are trained to improve their knowledge of operation and maintenance procedures, energy conservation fundamentals, new technologies, and other skills to improve building performance. Many of the higher education facilities managers across the Commonwealth are APPA certified and are implementing the methods and practices learned through the APPA institute to improve the operation of their facilities.

5. Designating an agency energy manager is a best practice critical to ensuring efficient use of energy in state facilities. Energy savings initiatives are most successful with a champion. Approximately 25 agencies in the Commonwealth have a dedicated staff person focusing primarily on energy savings projects. It is clear that agencies with dedicated staff are better able to meet the goals of the Commonwealth in reducing agency energy consumption and costs.

## Best Practice Recommendations

### 1. Create a Virginia Energy Management Program (VEMP)

**Current Situation** – The Department of Mines, Minerals, and Energy (DMME) supports energy efficiency by acting as the technical specialist for statewide energy contracts, reporting on energy consumption, and supporting agencies with performance contracting projects. The Department of General Services (DGS) has three groups that work on statewide energy-related issues: the Division of Engineering and Buildings (DEB), the Bureau of Capital Outlay Management (BCOM), and the Division of Purchases and Supply (DPS). DEB administers the statewide contract for performance contracting, BCOM reviews capital projects, and DPS administers the statewide contracts for electricity, natural gas, and heating oil. All agencies may issue purchase orders against these statewide contracts. Plans for all new buildings and major renovations are reviewed by BCOM. The Department of Transportation (VDOT) handles the contract for the majority of gasoline used by state vehicles.

Facility operation and maintenance (O&M) functions are handled by individual agencies. There is little coordination of activities among agencies. Because there are no established statewide guidelines for operation and maintenance of state facilities, including training, budget development, standard maintenance schedules, etc., each agency develops and implements guidelines for its facilities. There is limited opportunity to share lessons learned across agency boundaries.

**Best Practice** – The best practice we recommend is the creation of a central organization with the mission to reduce energy consumption and costs associated with energy. An excellent example of this best practice is the Federal Energy Management Program.

**Recommendation** – A central organization patterned after the federal best practice should be formed in state government to provide energy management services to state agencies. This group would be named the Virginia Energy Management Program (VEMP). It would reside in the Department of Mines, Minerals, and Energy.

This central group would provide support, outreach, and training to agency facility staff including agency energy managers, facility operators, maintenance and operations personnel, procurement, and administrators. This group would also provide specialized technical expertise to agencies to improve their knowledge of operation and maintenance procedures, energy conservation fundamentals, new technologies, and other skills to improve building performance. VEMP would be responsible for implementing many other recommendations in this study.

A central VEMP advisory group made up of energy managers from several agencies and institutions would advise VEMP on the needs of the agencies and provide feedback on the benefit this group brings to agency operations. The group would help bring a consistent level of knowledge and technical support to all agencies. The group would direct what types of training agencies need, provide technical support on energy-related issues, facilitate communication among agencies, and orchestrate outreach to all state employees to educate them about energy conservation best practices they can use. Training could be coordinated through the Association of Physical Plant Administrators (APPA), vendors, and other training providers.

VEMP would also support new technology applications and innovative technologies such as renewable energy, smart meters, demand response, combined heat and power, and geothermal. VEMP would test new technologies, share the results with all agencies, provide support to justify any additional first costs, and provide incentives for new technology and innovation.

Other recommendations that would be implemented through the VEMP include building commissioning/re-commissioning, automated utility billing, demand response program, and encouragement of telework and use of mass transportation.

**Implementation** – DMME has one state-funded position supporting agencies with performance contracting and natural gas procurement and two federally funded positions supporting agency energy contracts, efficiency efforts, and energy reporting. It is recommended that the VEMP activities be funded entirely from state general funds. This would make the federally funded positions available for activities benefiting all Virginians, not just internal state government operations. The one current state-funded position would become part of the VEMP. VEMP would then consist of the following positions:

**Manager** – Program administration, chair utility procurement committee, chair energy manager advisory committee, manage EDI initiative contractor, and manage the commissioning/re-commissioning pilot
**Demand Response Manager** – Manage the statewide electrical demand response program
**Performance Contracting Specialist** – Support agency performance contracting projects
**Coordinator** – Coordinate statewide training program and EO-48 agency energy reporting
**Budget** – $440,136 GF per year to support the three new VEMP positions including $50,000 for agency energy manager training expenses
**Manpower** – 4 FTE

**Benefits** – The dollar benefits to the Commonwealth cannot be precisely quantified and will vary across agencies. Those agencies now following best practices will realize a small savings, while those that are not will realize larger savings. As shown in Appendix 1, the Commonwealth spent approximately $240 million on energy in FY 2006. A United States Department of Energy report notes that improved operating and maintenance can reduce energy consumption by up to 19%. Since Virginia agencies have implemented some best management practices, the Commonwealth would not see this level of savings. Reducing the federal Department of Energy estimate in half due to the previous state practices, it is estimated that state facilities could reduce energy costs by approximately $20 million per year.

## 2. Aggregated Procurement of Natural Gas

**Current Situation** – At present, some Virginia agencies and institutions procure natural gas services using the statewide natural gas marketer contract. The natural gas contract allows the use of various hedging mechanisms including seasonal natural gas storage, futures, and cap and slide. Because each individual agency procures a relatively small quantity of gas, it can only spend a limited amount of time managing the process and often does not get the best deal.

**Best Practice** – The best practice we recommend is to have knowledgeable energy procurement specialists procure energy for the Commonwealth. This best practice has been used in several other states including New York, Maryland, Pennsylvania, and California.

**Recommendation** – The Commonwealth should aggregate its natural gas needs and have centrally employed purchasing specialists purchase natural gas for all agencies. Specialists would develop and implement a procurement plan to meet agency budget requirements, lower risk, ensure adequate supply, and obtain the lowest price available.

By purchasing in blocks of 10,000 decatherms, there would be additional savings that are not available to agencies under the present structure. Additional savings can be achieved by negotiating rates with the local distribution and transmission companies providing

natural gas to Commonwealth facilities. These energy specialists could also procure other energy used by state facilities including electricity from conventional sources, electricity from renewable sources, heating oil, propane, coal, and wood.

Through aggregated procurement of natural gas, the Commonwealth has the potential to avoid between $8-$10 million in natural gas costs annually based on using leveraged buying power, negotiated transport rates, and negotiated distribution rates.

**Implementation** – The procurement specialists could reside in VEMP within the Department of Mines, Minerals, and Energy. They would issue purchase orders using contracts put in place by the Department of Purchases and Supply. A committee chaired by the VEMP manager, the two energy procurement specialists, and the DGS/DPS utilities contract administrator would approve procurement decisions. This group will coordinate with the Department of Planning and Budget to determine how to aggregate and disburse funds to pay for the natural gas.

**Budget** – $279,154 GF per year to support 2 positions
**Manpower** – 2 FTE

**Benefits** – Based on FY2006 expenditures for natural gas, the estimated potential cost avoidance for the Commonwealth is $8 to $10 million. Below is a breakdown of costs that could be avoided:

$65,549,887 FY 2006 total dollars spent on natural gas (source DOA)

Estimated avoided costs:

| | |
|---|---|
| $ 6,555,000 | Commodity savings using aggregated procurement and storage |
| $ 394,000 | Firm capacity savings due to aggregated procurement |
| $ 983,000 | Rate reduction from state contract with transmission companies |
| $ 328,000 | Savings from buying 10,000 decatherm blocks of gas |
| $ 1,966,000 | Rate reduction for state contract with distribution companies |
| $10,226,000 | Total avoided costs (approximately 15% of total costs) |

### 3. Establish a Commissioning/Recommissioning Pilot for State-Owned Buildings

**Current Situation** – Studies have shown that the payback to re-commission an existing building can be as low as 8.4 months. Actual payback will vary as there is considerable variation in the level of operation and maintenance occurring in facilities. There are approximately $2.5 billion in maintenance projects with $23 million under the Energy heading in the Facility Inventory and Condition Assessment System (FICAS). This shows that there is a large opportunity for re-commissioning in Commonwealth buildings.

**Best Practice** – The best practice we recommend is to periodically commission buildings in the Commonwealth inventory. This best practice has been used by the federal government and many private companies and is a proven energy savings tool.

**Recommendation** – The Commonwealth should implement a building commissioning/re-commissioning pilot for state facilities, with program expansion based on confirmed savings in pilot state facilities.

**Implementation** – This initiative would be implemented as a VEMP program and would start with a pilot program of five buildings to determine the actual payback in state buildings re-commissioning. Future re-commissioning would be funded through other energy efficiency funds.

**Budget** – $200,000 to pay for a re-commissioning pilot
**Manpower** – To be implemented using VEMP personnel

**Benefits** – Based on industry studies, the pilot project would result in approximately $2,000,000 in avoided costs over a 10-year term.

**4. Automate Utility Billing**

**Current Situation** – Benchmarking energy use in state facilities is very difficult to accomplish given the information available today. The Commonwealth has tried two different systems to record and benchmark state facility energy use. Both relied on manual input from state agency personnel; neither has produced accurate, organization-wide data.

Current state budget systems identify where energy dollars are spent, but not how much energy was used. The Commonwealth receives over 10,000 paper utility bills each month and the information from these bills is manually entered into the state financial system for payment.

Without consistent data it is very difficult to benchmark any program and evaluate where improvement is needed. With automated utility billing, electricity and natural gas consumption data will be available for all agencies and for benchmarking energy consumption. This data would be used to determine which buildings are poor performers and provide the necessary information to prioritize energy consumption reduction efforts.

**Best Practice** – The best practice we recommend is to electronically transfer energy use and cost data from energy suppliers rather than using manual data entry and populate a database for making energy conservation decisions. Numerous private companies use a centralized Electronic Data Interchange (EDI) system to manage energy bills.

**Recommendation** – The Commonwealth should develop an EDI system to track and manage energy consumption among Commonwealth facilities. EDI would allow the Commonwealth to begin measuring energy costs and consumption and identify

performance-based energy opportunities while reducing the time needed to manually enter billing data. As the database becomes populated, it would allow the Commonwealth to use the data to evaluate, analyze, and measure building performance using the ENERGY STAR Portfolio Manager tool.

This effort should be developed to interface with the state's new Enterprise Financial System (EFS). Development of EFS will take several years and information from an EDI project is needed now to manage energy in the Commonwealth. Therefore it is recommended that an EDI project be interfaced with the existing Commonwealth Accounting and Reporting System (CARS) while EFS is in the planning stage.

The VEMP Manager would take the lead and form an implementation committee consisting of representatives from of the Department of Accounts (DOA), Department of Planning and Budget (DPB), Department of Treasury (DOT), and two agencies that will be using the system. Dominion Virginia Power would be the first utility where EDI will be implemented. EDI would then be implemented with other utility providers.

A first step would be the decision to implement EDI using primarily state resources or select a vendor to implement a system. The implementation committee would determine where the EDI program would reside, who would be responsible for operation and maintenance, how program costs would be covered, and any other issues involved in the long-term success and operation of the program.

**Implementation** – A plan would be developed and implemented by the EDI Implementation Committee.

> **Budget** – DMME has $230,000 from federal energy efficiency grant budgeted for this project.
> **Manpower** – To be implemented by contract managed by VEMP staff

**Benefits** – The Commonwealth has no mechanism to benchmark energy consumption, other than dollars. This project would give a benchmark tool that would allow accurate measurement of energy units consumed and better planning of energy savings investments. It would eliminate the need for manual entry of over 10,000 paper utility bills into the state accounting system each month, eliminate entry errors, and reduce utility late payment charges.

## 5. Self-fund Energy Efficiency Projects with a State Revolving Fund

**Current Situation** – There are a number of barriers to more widespread use of energy savings performance contracts. Universities in particular have found that significant barriers, such as the debt incurred, limit use of energy savings performance contracts. Use of operating funds limits the size of energy conservation projects. Projects that exceed $3 million are subject to the capital budget process, limiting the size of any single energy savings performance contract without crossing what agencies consider a significant barrier.

**Best Practice** – The best practice we recommend is to use Commonwealth funds to pay for energy efficiency projects instead of borrowing money to do these projects.

**Recommendation** – The Commonwealth should create a $20 million energy savings project revolving fund to finance energy projects. This fund would be administered by VEMP. Agencies would use operating budgets to pay back into the fund over an agreed-upon period from the accrued energy savings. To increase the size of the fund for future projects, a fee of 1% would be added to the amount to be repaid by the agency. An agency borrowing $2,000,000 for 5 years would repay $2,020,000 over the term of the agreement.

The Department of Planning and Budget has a streamlined approval process for approval of energy savings performance contracts above the $3 million threshold. VEMP staff would work with DPB to educate agencies on how to use the approval process to eliminate this barrier to implementing larger energy savings performance contracts.

**Implementation** – Agreements for use of the funds would be implemented through a Memorandum of Understanding (MOU) between DMME and the agency requesting the funds with payment by electronic funds transfer.

**Budget** – A one-time appropriation of $20 million
**Manpower** – To be implemented using VEMP and existing agency personnel

**Benefits** – This funding mechanism would allow the Commonwealth to "borrow from itself" because agencies would use existing funds. Based on the savings generated through avoided costs, money would be generated and distributed back into the fund for future projects.

## 6. Establish a State Facility Demand Response Program

**Current Situation** – The state has many diesel generators used for emergency electrical power. Each agency has control of its generation capacity. There is no database of the emergency generating capacity across state agencies. Agencies may also have significant loads that could be curtailed during times of peak energy demand.

There are significant opportunities in the PJM Demand Response Program with a statewide demand response program. This program would provide a financial benefit to the state and help take load off the grid in an electrical peak demand or emergency condition. There are two components of the program. One has customers reduce load only in an emergency for a fixed payment. The other has consumers reduce load on a more regular basis for an additional financial payment.

**Best Practice** – The best practice we recommend is to put a program in place that will allow state agencies to take advantage of the PJM Demand Response Program. This best practice is being used by both public and private organizations in the northeastern states.

**Recommendation** – The Commonwealth should develop a database of emergency electric generation equipment and capacity and a communication system to coordinate agency and university participation in the PJM Demand Response Program. Upon a demand peak or emergency, each agency would decide to participate in the program. The PJM demand reduction program payments would be returned to the agencies to offset other utility costs.

**Implementation**

**Budget** – There would be some expense to develop a statewide generator database and communication system for agencies to use in a peak or emergency demand control time. This task needs to be further developed to establish a budget.
**Manpower** – To be implemented using VEMP and existing agency personnel

**Benefits –** State agencies and institutions would be better prepared to help Virginia respond to an electric supply emergency and would receive a financial benefit from using existing resources. The dollar benefit cannot be defined until a database of generation assets is developed.

**7. Encouragement of Telework and Use of Mass Transportation**

**Current Situation** – Since the implementation of the telework policy went into effect in 2000, roughly 5% of state employees use a telework option. History has shown that barriers to increasing the number of employees teleworking stem from a lack of support from agency management due to untrained managers and security-related issues with remotely accessing state web tools and emails.

**Best Practice** – The best practice we recommend is to encourage the use of proven telework practices and technologies in the Commonwealth. This best practice is currently being used in federal government and in some state agencies. The Department of Taxation is the lead state agency piloting telework.

**Recommendation** – Increase the number of employees who use telework and mass transportation opportunities. This would reduce employee commute times and remove

some single passenger vehicles from the road. Governor Kaine has set a goal to have 20% of state employees (roughly 23,000 out of 115,000) teleworking by 2010. Agencies should begin adopting a consistent telework policy for all eligible employees.

To ensure a successful telework policy, the Committee recommends the following steps:

a. Education is needed to increase and enhance level of training for management and employees. The Department of Human Resource Management (DHRM) should continue to work with agencies on how to adopt a policy that is consistent with state goals and initiatives. Agency managers and supervisors should take the DHRM training on how to manage teleworking employees.
b. The VITA, through its contract with Northrup Grumman, should provide technologies to teleworking state employees that allow secure access to agency automated systems.
c. Identify who is eligible (essential personnel vs. non-essential) and create/update the database of all employees for accurate tracking of telework use.

**Implementation**

***Budget*** *– No additional budget is required.*

**Manpower** – No additional staff is required. The Office of Telework Promotion and Broadband Assistance and the Department of Human Resources Management are already tasked to assist agencies in implementing the new telework policy.

**Benefits** – Adopting a telework policy can result in reducing energy usage and environmental impacts. Teleworking can allow employees to share desks, print facilities and equipment, VITA support, and parking. More widespread use of telework can improve employee retention and attract a new workforce to state employment.

**8. Agency Participation in the Virginia Environmental Excellence Program**

**Current Situation** – In 2005, the Virginia General Assembly adopted legislation to create the Virginia Environmental Excellence Program (VEEP). This encourages superior performance through environmental management systems and pollution prevention. Currently, there are 85 state agencies participating in the program. VEEP has allowed participants to network with their peers and focus on regional environmental priorities. Agencies already implementing energy-based performance projects could easily dovetail with the VEEP program.

**Best Practice** – The best practice we recommend is to capitalize on the synergy between energy conservation and reducing pollution. It is clear that reducing energy consumption reduces the pollutants resulting from energy generation.

**Recommendation** – State agencies and institutions should be encouraged to participate in the Virginia Environmental Excellence Program to further demonstrate a commitment to enhanced performance in building operations.

**Implementation** – Coordinate with the Department of Environmental Quality (DEQ) to reach out to the remaining state agencies to encourage their participation in the program.

**Budget** – No additional funding is required.
**Manpower** – VEMP and the DEQ would coordinate an outreach effort to the remaining agencies.

**Benefits** – Dollar benefits would be hard to quantify as cost savings will vary across multiple agencies. DEQ and DMME could provide additional recognition for state agency efforts.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# APPENDIX 1 - COSTS FROM DEPARTMENT OF ACCOUNTS

**Energy Costs for State Facilities**

| | Coal | Natural Gas | Fuel Oil | Steam | Wood Fuel | Electrical Service | |
|---|---|---|---|---|---|---|---|
| | 1321 | 1322 | 1324 | 1325 | 1326 | 1542 | Total |
| FY 2006 | $6,067,624 | $65,549,888 | $14,104,367 | $13,473,297 | $426,177 | $143,502,979 | $243,124,331 |
| FY 2005 | $5,700,212 | $49,226,444 | $10,541,216 | $7,387,113 | $384,030 | $134,739,219 | $207,978,233 |
| FY 2004 | $4,558,747 | $39,314,281 | $8,109,102 | $6,571,215 | $338,827 | $125,817,958 | $184,710,130 |
| FY 2003 | $4,247,158 | $33,610,413 | $7,641,546 | $4,308,555 | $285,033 | $125,875,819 | $175,968,523 |
| FY 2002 | $4,415,295 | $24,932,681 | $4,282,159 | $4,516,517 | $363,580 | $123,071,071 | $161,581,303 |
| 5 Year Total | $24,989,037 | $212,633,706 | $44,678,390 | $36,256,696 | $1,797,647 | $653,007,046 | $973,362,521 |

**Repair and Maintenance Costs in State Facilities**

| | Electrical Repair/Maint Services | Electrical Repair/Maint Materials | Mechanical Repair/Maint Services | Mechanical Repair/Maint Materials | |
|---|---|---|---|---|---|
| | 1252 | 1353 | 1256 | 1354 | Total |
| FY 2006 | $12,333,922 | $13,361,591 | $27,117,672 | $20,813,444 | $73,626,629 |
| FY 2005 | $12,821,372 | $14,097,967 | $24,319,348 | $22,741,378 | $73,980,064 |
| FY 2004 | $9,355,322 | $12,137,278 | $23,391,614 | $30,433,187 | $75,317,402 |
| FY 2003 | $8,205,675 | $11,141,591 | $24,288,096 | $24,197,895 | $67,833,258 |
| FY 2002 | $8,763,467 | $12,224,782 | $23,808,189 | $20,881,061 | $65,677,498 |
| 5 Year Total | $51,479,757 | $62,963,209 | $122,924,919 | $119,066,965 | $356,434,851 |

Object Code definitions:

1321, Coal: Include expenditures for coal or coke consumed in transportation, heating, and/or power generating plants. Include the cost of transporting the coal.

1322, Gas: Include expenditures for natural and manufactured gas consumed for cooking, heating, power generating plants, and laboratories.

1323, Gasoline: Include expenditures for diesel fuel, gasoline, or similar fuel consumed in the engines and motors of aircraft, motor vehicles, power equipment, and watercraft.

1324, Oil: Include expenditures for fuel oil, oil, and oil derivatives consumed in heating, and/or power generating plants. Include the cost of transporting the oil.

1325, Steam: Include expenditures for steam consumed in heating and/or power generating plants purchased from a second party.

1326, Wood Fuels: Include expenditures for wood products used for fuel for heating and power generating plants, to include such items as round wood, chips, sawdust, and bark. Include transportation costs.

1542, Electrical Service Charges: Include expenditures for electricity.

1252, Electrical Repair and Maintenance Services: Include expenditures for services provided to repair and maintain electrical systems (including network cabling) in buildings, shelters, towers, and on grounds.

1353, Electrical Repair and Maintenance Materials: Include expenditures for circuit breakers, circuits, electrical tape, fuses, plugs, tubes, wiring, and similar electrical repair and maintenance materials not included in the cost of the work performed under contract.

1517, Boiler and Machinery: Include expenditures for insurance coverage of energy equipment.

2133, Utilities: Include expenditures for lines and facilities (e.g., energy) used in the transmission of electricity, gas, sewer, water, and similar utilities.

2282, Fixtures: Include expenditures for electrical, heating, lighting, plumbing, and similar fixtures normally affixed to walls, floors, and ceilings.

1256, Mechanical Repair and Maintenance Services: Include expenditures for services provided to repair and maintain air conditioners, elevators, furnaces, plumbing, and other mechanical equipment.

1354, Mechanical Repair and Maintenance Materials: Include expenditures for bolts, cable, gears, nuts, pipe screws, solder, and similar mechanical repair and maintenance materials not included in the cost of work performed under contract.

*Note: There may be some overlap of expenditures between steam and other fuels in cases where agencies pay for fuel to generate steam and then bill other agencies or departments for steam usage.*

# 2010 Energy Study - Appendix 2
# FY 2008 - 2010
# Summary of State Energy Expenditures

Summary of Operational Review Energy Expenditure Codes FY 2008 - 2010

(ACTR1439A3)

| | Coal | Gas | Gasoline | Oil | Steam | Wood Fuels | Electrical Service Charges | Utilities | |
|---|---|---|---|---|---|---|---|---|---|
| | 1321 | 1322 | 1323 | 1324 | 1325 | 1326 | 1542 | 2133 | Grand Total |
| Agency | | | | | | | | | |
| FY 2008 | 1,262,148.75 | 19,375,706.02 | 56,925,185.87 | 8,655,260.29 | 1,661,563.36 | 238,678.73 | 51,959,956.78 | 1,524,579.22 | 141,603,079.02 |
| FY 2009 | 2,549,664.64 | 19,721,728.86 | 49,311,894.41 | 7,118,151.08 | 1,853,018.30 | 322,395.40 | 62,232,800.91 | 1,973,677.41 | 145,083,331.01 |
| FY 2010 | 1,264,630.36 | 15,652,993.66 | 43,214,068.81 | 6,523,531.88 | 1,602,868.70 | 417,994.41 | 60,424,124.22 | 1,554,492.84 | 130,654,704.88 |
| 3 Year Total | 5,076,443.75 | 54,750,428.54 | 149,451,149.09 | 22,296,943.25 | 5,117,450.36 | 979,068.54 | 174,616,881.91 | 5,052,749.47 | 417,341,114.91 |
| Higher Education | | | | | | | | | |
| FY 2008 | 9,969.17 | 25,785,327.69 | 3,203,287.28 | 1,451,592.22 | 7,612,091.73 | 231,203.57 | 43,713,801.84 | 3,109,893.05 | 85,117,166.55 |
| FY 2009 | 10,142,593.83 | 49,962,516.71 | 6,638,557.48 | 5,001,666.54 | 11,446,997.40 | 293,498.84 | 142,478,198.02 | 8,813,697.03 | 234,777,725.85 |
| FY 2010 | 9,044,731.88 | 32,977,925.02 | 6,168,758.71 | 3,576,880.13 | 11,882,503.54 | 293,219.59 | 142,327,010.23 | 7,053,178.21 | 213,324,207.31 |
| 3 Year Total | 19,197,294.88 | 108,725,769.42 | 16,010,603.47 | 10,030,138.89 | 30,941,592.67 | 817,922.00 | 328,519,010.09 | 18,976,768.29 | 533,219,099.71 |
| Combined Total | | | | | | | | | |
| FY 2008 | 1,272,117.92 | 45,161,033.71 | 60,128,473.15 | 10,106,852.51 | 9,273,655.09 | 469,882.30 | 95,673,758.62 | 4,634,472.27 | 226,720,245.57 |
| FY 2009 | 12,692,258.47 | 69,684,245.57 | 55,950,451.89 | 12,119,817.62 | 13,300,015.70 | 615,894.24 | 204,710,998.93 | 10,787,374.44 | 379,861,056.86 |
| FY 2010 | 10,309,362.24 | 48,630,918.68 | 49,382,827.52 | 10,100,412.01 | 13,485,372.24 | 711,214.00 | 202,751,134.45 | 8,607,671.05 | 343,978,912.19 |
| 3 Year Total | 24,273,738.63 | 163,476,197.96 | 165,461,752.56 | 32,327,082.14 | 36,059,043.03 | 1,796,990.54 | 503,135,892.00 | 24,029,517.76 | 950,560,214.62 |

*Object Code/Description*

1321, Coal: Include expenditures for coal or coke consumed in transportation, heating, and/or power generating plants. Include the cost of transporting the coal.

1322, Gas: Include expenditures for natural and manufactured gas consumed for cooking, heating, power generating plants, and laboratories.

1323, Gasoline: Include expenditures for diesel fuel, gasoline, or similar fuel consumed in the engines and motors of aircraft, motor vehicles, power equipment, and watercraft.

1324, Oil: Include expenditures for fuel oil, oil, and oil derivatives consumed in heating, and/or power generating plants. Include the cost of transporting the oil.

1325, Steam: Include expenditures for steam consumed in heating and/or power generating plants purchased from a second party.

1326, Wood Fuels: Include expenditures for wood products used for fuel for heating and power generating plants, to include such items as round wood, chips, sawdust, and bark. Include transportation costs.

1542, Electrical Service Charges: Include expenditures for electricity.

2133, Utilities: Include expenditures for lines and facilities (e.g., energy) used in the transmission of electricity, gas, sewer, water, and similar utilities.

# 2010 Energy Study - Appendix 3
# Report of State Energy Savings Performance Contracting

**Performance Contract Report August 2010**

| Agency | Contract Date | Contract Term | Contract Total $ |
|---|---|---|---|
| Northern Virginia CC - Manassas | May-05 | 15 years | $440,402 |
| Virgnia Highlands CC | February-05 | 15 years | $614,583 |
| Wytheville CC | September-05 | 15 years | $4,846,360 |
| Patrick Henry CC Phase I & II | July-05 | 15 years | $2,201,039 |
| John Tyler CC | July-05 | 15 years | $2,116,466 |
| Piedmont Virginia CC | December-05 | 15 years | $873,959 |
| Northern Virginia CC - CT Building | January-06 | 15 years | $1,354,105 |
| Northern Virginia CC - Woodbridge | February-06 | 15 years | $5,172,254 |
| Danville CC | May-06 | 15 years | $2,539,879 |
| Soutwest Virginia CC | May-06 | 15 years | $2,890,774 |
| Thomas Nelson CC | October-06 | 15 years | $5,209,412 |
| Paul D. Camp CC | May-07 | 15 years | $1,471,491 |
| Northern Virginia CC - Annandale | January-07 | 15 years | $10,468,072 |
| Blue Ridge CC | January-07 | 15 years | $3,383,601 |
| Rappahannock CC | September-07 | 15 years | $1,217,242 |
| Lord Fairfax CC | January-07 | 15 years | $1,375,097 |
| Central Virginia CC | March-08 | 15 years | $1,744,628 |
| Mountain Empire CC | July-07 | 15 years | $3,018,146 |
| J. Sargeant Reynolds CC Phase I & II | April-08 | 15 years | $6,334,926 |
| Germanna CC | April-08 | 15 years | $1,504,132 |
| Virgnia Western CC | February-09 | 15 years | $1,791,344 |
| Tidewater CC | April-09 | 15 years | $3,368,031 |
| Tidewater CC Central Plant | June-09 | 15 years | $2,667,462 |
| New River CC | September-09 | 15 years | $4,761,100 |
| College of William and Mary | March-05 | 15 years | $1,888,689 |
| Virginia Commonwealth University - Ph 1 | May-05 | 10 years | $2,357,659 |
| Virginia Military Institute | September-07 | 15 years | $705,572 |
| Virginia National Guard | April-06 | 15 years | $310,791 |
| Virginia Commonwealth University - Ph 3 | May-06 | 7 years | $787,222 |
| Virginia National Guard Phase 2 | September-08 | 15 years | $1,528,892 |
| Southside Virginia Training Center | June-05 | 15 Years | $14,369,070 |
| Central Virginia Training Center | February-06 | 10 Years | $5,169,606 |

| | | | |
|---|---|---|---|
| Catawba Hospital Catawba, VA | October-06 | 15 Years | $2,728,379 |
| Southwest Virginia Higher Education Center | June-08 | 15 Years | $887,931 |
| Department for the Blind and Vision Impaired | February-09 | 15 Years | $1,717,954 |
| Southern Virginia Mental Health Institute | May-09 | 10 Years | $4,872,405 |
| Department of Forensic Science | December-09 | 15 Years | $11,063,199 |
| DMME Big Stone Gap | May-10 | 15 Years | $575,318 |
| VEC | September-03 | 12 Years | $1,404,081 |
| SWVTC | November-08 | 10 Years | $1,208,080 |
| University of Mary Washington | March-05 | 15 years | $8,526,314 |
| Old Dominion University | April-06 | N/A | $2,689,500 |
| Old Dominion University Phase 2 | March-08 | N/A | $982,747 |
| George Mason University Phase I | March-05 | 15 years | $12,215,500 |
| Richard Bland College | June-08 | 15 years | $1,996,144 |
| Science Museum of VA | April-08 | 10 years | $3,500,000 |
| VA Museum of Fine Arts | July-08 | 15 years | $5,803,828 |
| George Mason University Phase II | Aug-09 | 15 years | $8,290,302 |
| Dept. of Corrections Phase 1 | May-05 | 15 years | $9,504,287 |
| Virginia State University | Apr-06 | 15 years | $2,729,130 |
| Dept. of Corrections Phase 2 | May-07 | 15 years | $12,913,271 |
| Dept. of Corrections Phase 3 | Aug-08 | 15 years | $16,121,647 |
| Norfolk State Univ Phase I | March-04 | 12 years | $2,147,705 |
| Norfolk State Univ Phase 2 | May-05 | 15 years | $11,995,063 |
| Virginia School of the Deaf and the Blind | December-03 | 12 years | $1,953,083 |
| Woodrow Wilson Rehabilitation Center | October-05 | 15 years | $2,600,803 |
| Southwestern Virginia Mental Health Institute | November-05 | 15 years | $1,628,725 |
| | | | |
| | | | **$228,537,402** |

| **New Projects** | **Projected Contract Date** |
|---|---|
| Longwood University | September-10 |
| WWRC | September-10 |
| Virginia National Guard | October-10 |
| Paul D. Camp CC | March-10 |
| JSRCC Downtown Campus | August-10 |
| Department of General Services | August-10 |
| Piedmont Geriatric Hospital | October-10 |
| Virginia Tech | September-10 |
| VA Institute of Marine Science (VIMS) | August-10 |
| 600 East Main St., DGS | August-10 |

# 2010 Energy Report - Appendix 4
# Commonwealth of Virginia Demand Response Program

**September 8, 2010**

The Commonwealth of Virginia Demand Response program has been in place since September of 2007. The basics of the program are simple; State Bodies are paid to reduce their electric consumption at times when the electric grid is in stress. These Bodies will do this in response to economic price opportunities or grid emergencies. These programs are funded through grid operators and the costs are socialized through grid members, like Dominion Virginia Power. There are two types of demand response - emergency demand response and economic demand response. Emergency demand response is primarily needed to avoid outages. Economic demand response is used to help grid operators manage daily system peaks. EnergyConnect sends messages to State Participants when these grid situations arise. Today the program has 75 Commonwealth Bodies participating – realizing over 3.1 million dollars in payments this year.

**Actions to Achieve Demand Reductions:**

- **Lighting level reductions**
  Lighting level reductions are realized through turning off lighting and/or the use of programmable dimmable lighting ballasts. Lighting controls can be manual, lighting control systems, or Building Automation System (BAS).
- **Pre-cooling or pre-heating buildings**
  Takes advantage of the thermal mass of the building structure and its contents to allow a shifting of energy consumption to night when the wholesale prices are low.
- **Temperature adjustment**
  Use BAS to raise or lower the temperature of selected spaces by a pre-determined amount. Spaces that are temperature sensitive should be excluded.
- **Limit chiller current**
  Modern chillers have the ability to limit maximum current and power. This will allow cooling at a lower level of energy consumption with a small drift in space temperature.
- **Put building into early unoccupied mode**
  During unoccupied hours the following three measures are deployed by the BAS– space temperature is set back, outside air dampers are closed, and fans go from a continuous mode to on/off cycling.
- **Change static pressure set point or Variable Frequency Drive (VFD) speed on Variable Air Volume (VAV) systems**
  The supply-air static pressure or VFD speed can be reset to conserve fan energy.
- **Cycle constant volume fans and air handler units**
  Fans run at one fixed speed continuously. If the unit is half loaded one strategy would be to turn the fan on and off as done in most homes. Outside air requirements need to be considered with this measure. Units with carbon dioxide sensors and controls can automatically ensure the proper amount of outside air is brought into the building.

- **Increase chilled water supply temperature**
  Increasing chilled water temp decreases chiller energy usage.
- **Reduce supply air temperature on VAV systems**
  Reducing supply air temp will reduce amount of air needed to satisfy space temperatures.
- **Initiate Energy Management System (EMS) demand limiting schemes**
  Demand Limiting is a control function that enables management of peak demand level by shedding predefined loads when the building/facility demand nears a preset maximum.
- **Standby generators/ Cogeneration:**
  Generation and co-generation is effective if they can be operated for a few hours and are connected to large loads. Local environmental regulations must permit their use for other than emergency situations.
- **Thermal energy storage**
  The production of ice or chilled water is particularly well-suited to shifting electric demand from daytime hours where it is expensive to night-time hours where it is relatively inexpensive.

**Program Funding:**
These programs are funded through high voltage transmission grid operators and the costs are socialized through grid members, like Dominion Virginia Power. Payments are a redistribution of Demand Charges back to the consumer. Utilities charge demand fees to provide peaking service to customers. Those fees are collected as an insurance policy to provide 100% service even in the worst case scenario. By participating in Demand Response state participants are able to lower the overall cost of service by reducing their demand during peaks. The grid relies on EnergyConnect, a third-party aggregator, known as Curtailment Service Provider (CSP), to enroll customers; provide technical support and operating expertise; and pay customers for their participation. EnergyConnect receives payment on behalf of state bodies and then pays state participants 85% of those dollars for active participation.

**Program Benefits:**
- By encouraging participation in Demand Response (DR) the state is able to reduce the overall cost of electric service.
- Provides a funding mechanism for facility enhancements such as continuous commissioning, building control system upgrades, energy efficiency projects, purchasing renewable energy certificates or carbon credits, as well as for general fund purposes.
- DR helps limit increases in retail electricity prices by minimizing or even avoiding the use of the most expensive power plants that are typically operated to meet electric demand on those very hot or very cold days when electric demand and wholesale prices are highest.
- DR helps keep the air cleaner by reducing the use of the dirtiest power plants.
- If customers respond in a consistent, reliable fashion, DR reduces or defers the need for new power plants and electric transmission lines, which helps control the price of electric service, preserves wilderness and national park viewscapes, and limits emissions of CO2 and other harmful pollutants.

| Demand Response Payment Report based on enrollments through July 8, 2010 | | | | |
|---|---|---|---|---|
| | **Economic Demand** | **Emergency Demand** | **Emergency Demand** | **Totals** |
| **Participants** | **Response FY 2010** | **Response FY 2010** | **Response FY 2011** | |
| | | | | |
| ACPS - TC Williams High | non participant | non participant | non participant | |
| Blacksburg-V.P.I. Sanitation Authority | non participant | non participant | $23,206.77 | $23,206.77 |
| City of Newport News - Chickahominy Pump Station | non participant | non participant | $70,836.42 | $70,836.42 |
| City of Newport News - Diascund Pump Station | non participant | non participant | $12,166.56 | $12,166.56 |
| City of Newport News - Lee Hall Water Treatment | non participant | non participant | $43,258.88 | $43,258.88 |
| City of Newport News - LH2 | non participant | non participant | $5,677.73 | $5,677.73 |
| City of Newport News - RO Plant | non participant | non participant | $9,030.29 | $9,030.29 |
| City of Norfolk 37th Street Water Treatment Plant | non participant | non participant | $48,417.99 | $48,417.99 |
| City of Norfolk Moors Bridges Water Treatment Plant | non participant | non participant | $177,707.97 | $177,707.97 |
| City of Norfolk Western Branch Pump Station | non participant | non participant | $107,141.92 | $107,141.92 |
| City of Virginia Beach Dept of Public Utilities | non participant | non participant | $98,979.29 | $98,979.29 |
| County of Henrico - Admin Annex | non participant | $7,724.53 | $14,059.14 | $21,783.67 |
| County of Henrico - Administration | non participant | non participant | $50,072.15 | $50,072.15 |
| County of Henrico - Adult Detention Facility (Jail West) | non participant | non participant | $34,877.47 | $34,877.47 |
| County of Henrico - CAM - Woodman Rd | non participant | non participant | $12,166.56 | $12,166.56 |
| County of Henrico - Courthouse | non participant | non participant | $24,819.78 | $24,819.78 |
| County of Henrico - Depot/Public Works | non participant | non participant | $5,407.36 | $5,407.36 |
| County of Henrico - Juvenile Court and Probation | non participant | non participant | $12,166.56 | $12,166.56 |
| County of Henrico - Public Saftey | non participant | $9,307.43 | $12,166.56 | $21,473.99 |
| County of Henrico - Public Utilities Operations Center | non participant | non participant | $12,166.56 | $12,166.56 |
| County of Henrico - Regional Jail Facility (Jail East) | non participant | non participant | $46,527.90 | $46,527.90 |
| County of Henrico - Water Reclamation Facility | non participant | $74,700.00 | $158,219.35 | $232,919.35 |
| County of Henrico - Water Treatment Facility | non participant | $93,273.70 | $115,987.87 | $209,261.57 |
| Deerfield Correctional | non participant | non participant | $27,036.80 | $27,036.80 |
| Dillwyn Correctional Center | non participant | non participant | $21,629.44 | $21,629.44 |
| Eastern State Hospital | non participant | $11,080.27 | $18,925.76 | $30,006.03 |
| Fairfax - Herrity | $14,567.32 | non participant | non participant | $14,567.32 |
| Fairfax - Judicial Complex | $40,362.22 | non participant | non participant | $40,362.22 |
| Fairfax - Pennino | $9,836.42 | non participant | non participant | $9,836.42 |
| Fairfax County - Chantilly High School | $427.24 | non participant | non participant | $427.24 |
| Fairfax County - Hayfield Secondary | $897.09 | non participant | non participant | $897.09 |
| Fairfax County - Robinson Secondary | $817.83 | non participant | non participant | $817.83 |
| Fairfax County - S County Seconday | $713.39 | non participant | non participant | $713.39 |
| Fairfax County - WestfieldHighSchool | $548.65 | non participant | non participant | $548.65 |
| Fairfax County Govt | $15,217.41 | non participant | non participant | $15,217.41 |
| George Mason University | $118,822.31 | $32,174.85 | $81,110.40 | $232,107.56 |
| Greensville Correctional | non participant | non participant | $108,147.20 | $108,147.20 |
| Haynesville Correctional Facility | non participant | $27,689.16 | $46,132.16 | $73,821.32 |
| HRSD ARMY BASE TRMT PLT | non participant | non participant | $51,802.51 | $51,802.51 |
| HRSD ATLANTIC PLANT | non participant | non participant | $149,134.99 | $149,134.99 |

| | | | | |
|---|---|---|---|---|
| HRSD BOAT HARBOR PLANT | non participant | non participant | $77,811.91 | $77,811.91 |
| HRSD CHES/ELIZ PLANT | non participant | non participant | $114,041.22 | $114,041.22 |
| HRSD JAMES RIVER PLANT | non participant | non participant | $40,663.35 | $40,663.35 |
| HRSD NANSEMOND PLANT | non participant | non participant | $104,686.49 | $104,686.49 |
| HRSD VIP PLANT | non participant | non participant | $147,242.41 | $147,242.41 |
| HRSD WILLIAMSBURG PLANT | non participant | non participant | $94,736.95 | $94,736.95 |
| HRSD YORK RIVER PLANT | non participant | non participant | $59,859.48 | $59,859.48 |
| Jefferson Lab Facility – 40 MVA Substation | non participant | $158,289.55 | $328,664.75 | $486,954.30 |
| Jefferson Lab Facility – 7 MVA Substation | non participant | $31,657.91 | $51,239.74 | $82,897.65 |
| Keen Mountain Correctional Center | non participant | non participant | $49,711.48 | $49,711.48 |
| Noman M Cole Pollution Control Plant | $961.06 | $8,382.14 | $54,073.60 | $63,416.80 |
| Old Dominion University - Large Loop | $15,844.85 | $20,117.00 | $37,851.52 | $73,813.37 |
| PWC Public Works - Eastern District Police Station | non participant | $4,467.82 | $7,490.42 | $11,958.25 |
| PWC Public Works - George T. Owens Building | non participant | $10,872.15 | $19,440.69 | $30,312.84 |
| PWC Public Works - Public Safety Training | non participant | $3,268.14 | $6,246.73 | $9,514.87 |
| Red Onion State Prison | non participant | non participant | $58,237.65 | $58,237.65 |
| Reagan National Airport - North Substation | $1,827.86 | non participant | non participant | $1,827.86 |
| Reagan National Airport - South Substation | $987.29 | non participant | non participant | $987.29 |
| Southside Virginia Training Ctr | $5,389.10 | non participant | non participant | $5,389.10 |
| St. Brides Correctional Center | non participant | non participant | $63,806.85 | $63,806.85 |
| UVA - Cavalier Substation (11th St) | $77,128.48 | non participant | $108,147.20 | $185,275.68 |
| UVA - North Grounds | $47,216.90 | non participant | non participant | $47,216.90 |
| UVA - West End Alderman | $40,997.40 | non participant | non participant | $40,997.40 |
| VA DGS - 900 E Main | new enrollment! | non participant | non participant | $0.00 |
| VA DGS - Madison | new enrollment! | non participant | non participant | $0.00 |
| VA DGS - Monroe | new enrollment! | non participant | non participant | $0.00 |
| VA DGS - State Library 1 | new enrollment! | non participant | non participant | $0.00 |
| VA DGS - State Library 2 | new enrollment! | non participant | non participant | $0.00 |
| VCU Sanger 1 | $10,800.70 | $3,356.59 | $5,407.36 | $19,564.65 |
| VCU Sanger 2 | $13,278.08 | $4,363.50 | $7,299.94 | $24,941.52 |
| VCU School of Engineering | $6,039.32 | non participant | non participant | $6,039.32 |
| VCU - Medical Science Building | $14,172.48 | non participant | non participant | $14,172.48 |
| VCU - Siegel Center | $12,561.28 | non participant | non participant | $12,561.28 |
| VCU - Smith Building | $19,601.61 | non participant | non participant | $19,601.61 |
| Virginia Tech | new enrollment! | non participant | $162,220.80 | $162,220.80 |
| TOTAL | $469,016.29 | $500,724.74 | $3,197,860.88 | $4,167,601.91 |

Note - Emergency dollars are contracted amount. Accounts are paid monthly for being prepared to reduce load.

# 2010 Energy Report – Appendix 5
# State of Missouri Energy Project Report

## The State of Missouri
## a project by Johnson Controls, Inc.

### CASE STUDY OBJECTIVES

With approximately 32 million square feet and hundreds of buildings in its real estate portfolio, the State of Missouri spends $300 million annually to operate and maintain existing buildings. As a result of increasing energy costs, escalating real estate costs, and an ever increasing deferred maintenance backlog, the State announced, in 2005, a plan to reduce Statewide energy consumption by 15 percent by 2010.

Under performance contracting with guaranteed savings, Johnson Controls, Inc. (JCI) was commissioned to project manage the design and implementation of people and technologies to deliver a sustainable design plan to optimize the State's real estate portfolio. The task was to upgrade facilities and control and information management systems in approximately 1,000 buildings into a shared Building Information Management System using a portal that can bring disparate applications together.

This case study will examine the following elements of the project:

- Program and project management
- Integration of existing and new systems
- Real-time communications infrastructure
- Portal, dashboard, analytics, and control technology
- Financial viability of technologies and solution using ROI and energy savings
- Impact of the chosen technologies on energy and other less tangible factors

This case study will explore how the integration of systems can provide operational excellence as well as ease in maintaining individual system functionality by continuously monitoring, diagnosing and taking preventive actions remotely or from a centralized system.

### PROJECT OVERVIEW

In early 2007, Johnson Controls and TEAM CO-OP (a consortium of companies that brought technology and application elements to the bundled solution) began the implementation of a $24 million contract to upgrade facilities and control and information management systems in approximately 1,000 state-owned and operated buildings. Phase one of the project included a facilities assessment program to provide the State with a first ever comprehensive look at its real estate portfolio. To facilitate this portfolio assessment and

enable optimum management of facilities, a program needed to connect various silo systems and applications, such as:

- Utility bill management system
- Facilities communications infrastructure
- Building automation controls system
- Energy management system
- Asset condition management system
- Business process and capital planning management system
- Work order system
- Portal system for remote monitoring

Coupled with the installation of Web-enabled building control systems and a low-cost, wireless communications network, the project was guaranteed to save the State $9.5 million for the state every year through reduced energy usage, process improvements in facility automation, monitoring and management, and more efficient real estate portfolio management. On the environmental side, as a result of streaming building control and utility data into a shared network, the State can calculate its carbon footprint, regain control of the costs associated with their portfolio, and generate significant cost and energy savings.

## RESULTS

By integrating individual systems and buildings at a common user interface level, operational activities in the various subsystems can be monitored to detect inefficient operating conditions and corrective action can be taken to bring the system back to normalcy. This visibility over its facilities and assets enabled the State of Missouri to achieve the following results:

- Annual savings from the combined projects surpassed $35 million per year (equal to 370 percent of the guaranteed savings of $9.5 million per year)
- Expected payback on investment is about one year
- Reduction in Carbon footprint by:
    - 205,210,232 pounds of carbon dioxide
    - 307, 933 pounds of nitrogen oxide
    - 583,539 pounds of sulfur oxide

## PROJECT SCOPE

The overall scope of the project was to implement devices and systems that would allow for a much higher level of monitoring, measurement, management, verification, communication, and interoperability across the entire portfolio of buildings. A new system needed to enable the State to manage its portfolio of facilities from a total cost of ownership perspective and provide executives, managers, and staff the right information on a real time basis. The first task required was to understand how much energy is being used and collect information about expenses and resources and create a total life cycle model around decisive building assets.

Legacy system's incompatibility, outdated information, a lack of historical data, proprietary systems architectures, and dysfunctional operating processes were some of the hurdles which were resolved by the following aspects of the project:

- Integration of existing and new systems
- Design and development of real-time communications infrastructure
- Portal, dashboard, analytics, and control technology deployment

The integration between building automation systems and a wireless communications backbone helped deliver a complete building information management system to the facilities department. As it costs less to get buildings automated when they are built with wireless network infrastructure, wiring costs dropped around 30 percent, allowing Johnson Controls to justify providing enhanced sensing and control capability for the building. The building automation system greatly improved the interaction of mechanical subsystems in the buildings and lead to optimum energy consumption, cost-effective building operations, and improved occupant comfort.

## GUARANTEED SAVINGS

Under performance contracting with guaranteed savings, Johnson Controls played the role of the energy service company (ESCO) and accepted the performance risk to achieve the sustainable goals set forth by the State of Missouri. In guaranteed savings contracts, the customer leases the equipment from the financing company (who thereby absorbs this risk). The State's lease payments are assured through the savings guarantees by Johnson Controls. Thus, if savings are less than lease payments, Johnson Controls would make up the difference to the State, and extra savings are retained by the customer.

In retrofit performance contracting, funds to support the performance contracts come out of non-capital budgets for utility payments or operations and maintenance. This method obviates the need to seek approval for capital purchases. In this situation, Johnson Controls not only obtained the financing but also guaranteed the savings, which reduced the State's risk. Consequently, performance contracting can allow energy efficient technologies to be implemented without necessitating capital outlays.

## JOHNSON CONTROLS AND TEAM CO-OP

As the program and project manager, Johnson Controls was responsible for selecting and leveraging the cooperative efforts of companies involved in delivering the technology solutions to the State of Missouri. The Team CO-OP alliance was formed under Johnson Control's leadership to deliver a complete building information management system to the State's facilities department including a dashboard of information about their facility operating costs, capital spending and energy spending.

Team CO-OP direct partners for the State of Missouri project include

- ISCO International
- Talisen Technologies
- GridLogix
- Appian
- Johnson Controls, Inc.

The Team CO-OP solution, ESCO 2.0 (Enterprise Sustainability Contract), is a visionary approach to managing a portfolio of facilities from a global and total cost of ownership perspective. The integration of technologies and solutions allowed for a high level of connectivity for a variety of products from multiple manufacturers. Integrating intelligence is not only desirable but also becoming a mandatory requirement to provide clients with the best automation solutions, with the simplest connections to real-time data, Web-based data, and the corporate enterprise.

The key to the solution was to provide executives, managers, and workers with the information they required, on a real time basis, to make smart decisions. Using device networking technology and system integration, an intelligent building can be created, allowing control over virtually every system from a remote location. Based on their respective roles and access granted to individuals, detailed information can be viewed on a particular site, facility or function (that is, energy). Data and control information flow from a wide variety of software applications and Internet-enabled devices that are connected through secure communications to a user portal. Remote location access to all building systems is one of the boons of an intelligent building.

*Chart 1 – State of Missouri Facilities Dashboard*


There are many technologies that this project leverages to deliver a complete enterprise asset management capability and building information management system. The integration of technologies and solutions included a variety of products from multiple manufacturers, including:

- Talisen Secure Portal
- VFA Condition Assessment and Capital Planning software.
- IDS Energy Witness software
- Archibus CAFM and Space Planning software
- Appian Process Management and Orchestration software
- Armstrong SteamStar
- Microsoft SQL Server
- Cisco Systems IPICs
- Gridlogix EnNet Framework
- Dell Servers
- Sprint PCS Broadband
- Johnson Controls Metasys

Of course, an enterprise-wide project of this magnitude doesn't happen all at once. The deployment of these technologies was staged over the course of two years, delivering more value as the level of integration across the various technologies increased and facilitated the delivery of portfolio-wide facility data. Starting with the implementation of a software platform to provide facility condition and space planning information, the state of Missouri was able to rationalize their space requirements and justify the energy savings retrofit program with real data on the condition of all the major energy-consuming infrastructure in their portfolio. With the energy retrofit program came the deployment of technologies like Metasys for improved building automation and control, as well as the EnNet Framework, Energy Witness Software, Talisen Secure Portal and other IT technologies that would create the integrated system platform to provide real-time information on water, gas and electric utility usage, maintenance spending, capital investments and more. And through the creation of this platform, the state now has all the information they need to measure and verify the savings that were guaranteed by Johnson Controls as part of the overall project. This added benefit not only reduces typical measurement and verification costs, but provides the state with the information that they need to ensure that long-term energy, capital, real estate and maintenance costs remain under control and within budget.

## MEASURED RESULTS

The State of Missouri is considered by many as the most comprehensive North American green and intelligent project in the industry at present today in terms of scope, size, depth, and results. The project proves that with the required level of commitment and strategy significant cost savings and other benefits can be realized, such as:

- $35.6 million in annual savings from real estate, operations, construction, and utilities budgets
- Total Johnson Controls project cost $18.5 million, of a total project cost of $24 million
- Missouri's ESCO 2.0 Project had a return on investment of about one year.
- Reduction in Carbon footprint, including:
    - 205,210,232 pounds of carbon dioxide
    - 307, 933 pounds of nitrogen oxide
    - 583,539 pounds of sulfur oxide

With approximately 32 million square feet in its real estate portfolio, Missouri spends some $300 million annually to operate and maintain existing buildings. Johnson Controls guaranteed to save the State $9.5 and facilitated savings of $35.6 million by reducing energy usage, while ensuring process improvements in facility automation, monitoring and management, and more efficient real estate portfolio management.

**PILOT 1**

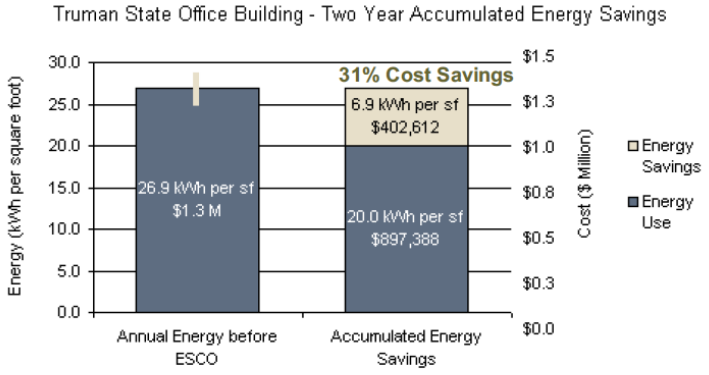
Truman State Office Building, Jefferson City, Missouri

775,000 square feet - the State's biggest office building

31 percent energy savings after two years (versus a guarantee of 17 percent)

In the base line year (the year before the ESCO), annual energy consumption for the Truman building was 26.9 Kilowatt hours per square foot or $1.3 Million in energy costs. The first year after ESCO, annual energy consumption dropped to 21.2 Kilowatt hours per square foot or $986,220 in total energy costs, generating savings of $313,780. In the second year, annual energy consumption was down to 20 Kilowatt hours per square foot and generated accumulated savings of $402,612, almost double of the guaranteed energy savings. Due to the savings and efficiency improvements achieved, the Truman State office building is now an Energy Star building.

*Chart 2 – Truman State Office Building reduction in energy consuption after two years*




**PILOT 2**

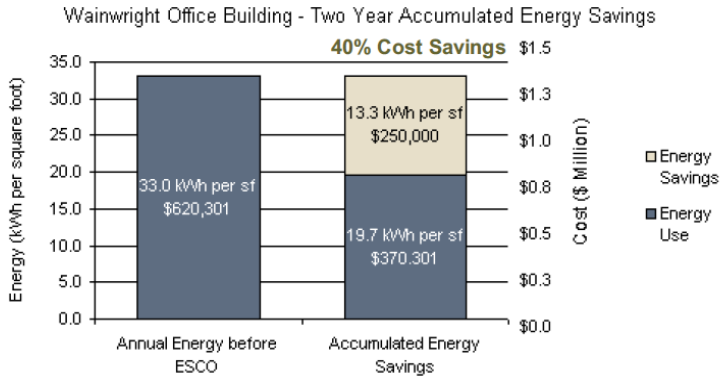
Wainwright Office Building, Downtown St. Louis, Missouri

234,000 square feet

40 percent energy savings after two years

In the base line year (the year before the ESCO), annual energy consumption for Wainwright office building was 33 Kilowatt hours per square foot or $620,301 in total energy costs. Two years after the ESCO, the annual energy consumption dropped to 19.7 Kilowatt hours per square foot and saved $250,000 in energy costs, $45,000 above the guaranteed savings anticipated.

*Chart 3 – Wainwright Office Building reduction in energy savings after two years*




The technologies, in conjunction with a few traditional energy conservation measures, have result in more annual savings than expected from the project. In the beginning, under performance contracting, Johnson Controls guaranteed on both buildings a total of $330,000. The State was actually able to save more than $400,000 on the Truman building alone.

The aim was to integrate all these systems into an intelligent system that can provide operational excellence as well as ease in maintaining individual system functionality by continuously monitoring, diagnosing, and taking preventive actions with scheduled maintenance. With the advancement of technology across all of the independent systems of a building, building control capability will continue to improve. Advances in networking technologies and the Internet have opened the door to a network-enabled world. Automated diagnostics supported by the latest sensors and control technologies can further lead to efficient building operations as well as to improvements in the life span of the structure. As this information is also available at remote locations, there are possibilities of achieving predictive fault detection, timely diagnosis, and prognosis. All these, in turn, makes it possible to create an intelligent building, which provides virtual control of every system from a central location.

FROST & SULLIVAN

# The State of Missouri an Independent Case Study

## CASE STUDY OBJECTIVES

The State of Missouri Enterprise Asset Management project is considered to be the most comprehensive North American green and intelligent project in the industry in terms of scope, size, depth, and results. This project leveraged many technologies to deliver a complete enterprise asset management solution to meet the sustainability goals set out by the State of Missouri.

State of Missouri was spending $300 million annually to operate and maintain approximately 32 million square feet spread across numerous facilities in its real estate portfolio. This case study will explore how the collaboration of companies and technologies enabled the State of Missouri to manage its portfolio of approximately 1,000 buildings from a total cost of ownership perspective. The goal of this project was to bring rapid and quantifiable cost savings and to provide executives, managers, and staff with the information they need, on a real time basis, to take smart decisions.

This case study will explore how the integration of systems has enabled the State of Missouri to have a dashboard of information about their facility operating costs, capital expenditures, and energy expenses at their fingertips, so they could make better decisions about how to manage their entire portfolio.

## PROJECT OVERVIEW

In the face of increasing energy costs, escalating real estate costs, and an increasing deferred maintenance backlog, in 2005, the State of Missouri announced plans to reduce state-wide energy consumption by 15 percent by 2010.

Driven by a new administration committed to a statewide sustainability program, the State of Missouri consolidated its real estate portfolio by integrating operations, maintenance, lease management, real estate management, design and construction services, and capital planning. The goal of the new administration was to manage its portfolio enterprise and lower the cost of ownership by addressing energy efficiency, cost of deferred maintenance, operating cost, space utilization, and asset management.

The aim of this project was to bring rapid and quantifiable cost savings in five key areas, namely:

1. Utility bill management
2. Automated enterprise monitoring
3. Facilities communications infrastructure
4. Portal collaboration
5. Business process management implementation and improvement

To manage its portfolio and reduce cost of ownership, the State had to determine what it owned in terms of facilities, locations, conditions, value, office space (both leased and vacant), capital needs utilization, energy usage, and cost of energy. Integrating buildings and systems at a common user interface level enabled operational activity monitoring to detect inefficient operating conditions and allowed corrective action to be taken to bring buildings back to normal performance patterns. Legacy system incompatibility, outdated information, a lack of historical data, proprietary systems architectures, and dysfunctional operating processes were some of the challenges which needed to be addressed.

On the environmental side, as a result of streaming building control and utility data in to a shared network, the State of Missouri, is currently able to calculate its carbon footprint, regain control of the costs associated with its portfolio, and generate significant cost and energy savings.

## RESULTS

By integrating individual systems and buildings in to a common user interface level, operational activities in the various subsystems can be monitored to detect inefficient operating conditions and corrective action can be taken to bring the system back to normalcy. This visibility over facilities and assets has enabled the State of Missouri to achieve the following results:

- Annual savings from the combined projects in excess of $35 million per year
- Expected ROI of about one year on the investment
- Reduction in carbon footprint:
    - 205,210,232 pounds of carbon dioxide
    - 307, 933 pounds of nitrogen oxide
    - 583,539 pounds of sulfur oxide

## PROJECT SCOPE

To efficiently manage its asset portfolio, manage its utility budget, project costs, and integrate accounting and work order system, the following technology parameters were deployed:

- Condition assessment opportunities covering the entire 32 million square feet of real estate
- Energy management system covering approximately 16.8 million square feet (not all facilities have control systems)
- Work order system and CAFM covering 24 million square feet of real estate

The State of Missouri invested in an Archibus CAFM and Space Planning software system to manage leases, perform condition assessment (conditions, deferred maintenance, asset inventory, and so on), create a project outline with a budget forecast, and manage energy consumption. The CAFM system was implemented to set standards and ensure consistency in maintenance operations and to manage work orders, predict maintenance orders, on demand work orders, and combine them with the purchase order system.

Before these parameters where employed, the State's utility bills went sent directly to the accounting department. Facility managers were unable to measure how much energy they were consuming. The new system enables this level of visibility by providing facility managers and other decision makers with access to information necessary to make changes to lower energy consumption and reduce the carbon footprint. This information further enabled facility managers to take corrective action on large inefficiencies such as air handling units (AHU) running all the time.

The enterprise asset management system, connected to the work order system, allows remote control from a centralized location, making it easier to analyze all sites across the state and to perform building analysis, identify maintenance needs and capital applications, as well as more effectively manage the activities of facility managers for thousands of sites. The goal was to provide executives, managers, and staff with information to make correct decisions depending on their individual roles and needs on a real time basis. With utility bills integrated into the enterprise asset management system, the facility managers can further provide diagnostic information and present it to staff in the organization, enabling them to take immediate action instead of waiting until the end of the month before realizing the bill is too high.

The ability to mine data automatically and present it not only at the 'C' level but also at the facility level and equips them to take some immediate action to reduce the energy consumption. In order to conserve energy, it is imperative to have proper information management architecture in place, in order to make the information actionable and definable:

- Computer rated facility management system for on-demand and preventative work orders and space management
- Capital planning condition assessment
- Building information management system
- Business process management tool for automating capital planning process
- Middleware software integrating existing disparate system and different control systems
- Gateway portal that enables external vendors such as JCI to manipulate the building controlsystem remotely

## INTEGRATION APPROACH

As the program manager and project manager, Johnson Controls Inc. (JCI) was responsible for selecting and leveraging the cooperative efforts of companies involved in delivering the technology solutions to the State of Missouri. TEAM CO-OP alliance was formed to deliver a complete building information management system. As a result, no company singularly contributed all the savings, but rather, the savings were the result of the combination of many technology contributors.

There were four key architectural partners at the beginning in the bid process for the State of Missouri project that formed Team CO-OP alliance, namely:

- ISCO International
- Gridlogix
- Johnson Controls, Inc.
- Talisen Technologies

The TEAM CO-OP solution, ESCO 2.0 (Energy Services Contract Organization), is a visionary approach to managing a portfolio of facilities from a global and total cost of ownership perspective. The integration of technologies and solutions allowed for a high level of connectivity for a variety of products from multiple manufacturers, such as:

- Talisen Secure Portal
- VFA Condition Assessment and Capital Planning software.
- IDS Energy Witness software
- Archibus CAFM and Space Planning software
- Appian Process Management and Orchestration software
- Armstrong SteamStar
- Microsoft SQL Server
- Cisco Systems IPICs
- Gridlogix EnNet Framework
- Dell Servers
- Sprint PCS Broadband
- Johnson Controls Metasys

Integrating intelligence is not only desirable but is also becoming a mandatory requirement to provide clients the best automation solutions with the simplest connections to real-time data, Web-based data, and the corporate enterprise. Jointly, Johnson Controls, Gridlogix, ISCO International, and Talisen Technologies delivered an integrated energy and maintenance management systems covering 17 million square feet of existing state facilities that include as many as 1,000 buildings.

Although the team of integrators experienced management and technical challenges typical to any project of this size, the end result is proof that the collaboration was a success. This approach also demonstrates that customers can assemble teams from best in class and are not dependant on a provider to deliver optimal results.

## JOHNSON CONTROLS, INC.

As the program manager and project manager, Johnson Controls was responsible for selecting and leveraging the cooperative efforts of companies involved in delivering the technology solutions to the State of Missouri. Under performance contracting with guaranteed savings, Johnson Controls also played the role of the energy service company (ESCO) and accepted the performance risk to achieve the sustainable goals set forth by the State of Missouri.

On the field, Johnson Controls orchestrated the connection of software to the building controls system, which, while sometimes simple upgrades, was often more complex. Johnson Controls' main focus was on the integration between building automation systems and a wireless communications backbone to help deliver a complete building information management system.

## GRIDLOGIX

GridLogix is a leading creator of XML Web Services based integration solutions for remote control and automation systems. Their solutions provided industry standard (open) interfaces to automation platforms so they can be integrated into the rest of an enterprise information network.

Gridlogix provided the core software architecture and data normalization technology as the interoperability layer. The software solution provided enabled the State of Missouri to integrate with existing control systems and applications to communicate together and help reduce energy, maintenance, compliance, and physical security cost.

In using this open technology provider, the State did not need to remove existing building controls systems. Instead, the solution allowed for fine tuning to extract the data needed from existing controls. The open system made it possible for multiple partners to work together instead of relying on one vendor, despite the different subordinate control systems.

Gridlogix agnostic middleware layer allowed the project to remove significant cost barriers to access the proprietary and legacy data from all the different systems that measure, monitor, and consume energy within a facility. Proprietary systems found in facilities often limit a customer's ability to pick the best and most affordable technologies. Gridlogix's open system architecture allowed the state and Team Coop to choose amongst best in class vendors, resulting in as much as an 80 percent reduction in total program cost when compared to a standard ESCO process. Gridlogix information management systems are optimized and used by customers aiming at almost up to 80 cents to a dollar per square foot of savings.

## TALISEN TECHNOLOGIES

Talisen is partnered with Appian, a provider of business process management (BPM) software. Talisen offers business process consulting and enablement of Appian's enterprise solution as well as its Web-based, hosted solution, Appian Anywhere™. The company addressed the issues pertaining to IT network, security, and wiring that enabled systems to interact over a reliable network architecture.

Talisen managed the deployment of PC's responsibility which typically required one connectivity or PC per site that which can have multiple buildings and networks connected through the local LAN or using a data center depending on reliability considerations.

## ISCO INTERNATIONAL

ISCO physically implemented the boxes and provided wireless systems solutions for subsystems and components for all wireless technology platforms. ISCO enabled seamless integration of technologies, and condition and enhance the radio frequency management and interference-control systems to provide the ultimate end-user wireless experience.

## MEASURED RESULTS

The State of Missouri is considered by many as the most comprehensive North American green and intelligent project in the industry, at present, in terms of scope, size, depth, and results. The project is proof that with the required level of commitment and strategy, significant cost savings and other benefits can be realized.

- Annual savings from real estate, operations, construction, utilities budgets $35.6 million
- Total JCI project cost $18.5 million
- Missouri's ESCO 2.0 Project had a return on investment of about one year.
- Reduction in Carbon footprint:
    - 205,210,232 pounds of carbon dioxide
    - 307, 933 pounds of nitrogen oxide
    - 583,539 pounds of sulfur oxide

With approximately 32 million square feet of facilities in its real estate portfolio, Missouri spends some $300 million annually to operate and maintain existing buildings. JCI guaranteed to save the State of Missouri $9.5 and facilitated savings of $35.6 million by reducing energy usage, process improvements in facility automation, monitoring and management, and more efficient real estate portfolio management.

## PILOT 1

Truman State Office Building, Jefferson City, Missouri

775,000 square feet - the State's biggest office building

31 percent energy savings after two years - almost double the guarantee

In the base line year (the year before the ESCO), annual energy consumption for the Truman building was 26.9 Kilowatt hours per square foot or $1.3 million in total energy costs. The first year after ESCO, the annual energy consumption dropped to 21.2 Kilowatt hours per square foot or $986,220 in total energy costs, generating savings of $313,780.

In the second year, annual energy consumption was down to 20 Kilowatt hours per square foot and generated accumulated savings of $402,612, almost twice the guaranteed energy savings. Due to the savings and efficiency accomplishments, the Truman State office building is currently an Energy Star building.

*Chart 1 – Truman State Office Building reduction in energy consumption after two years*

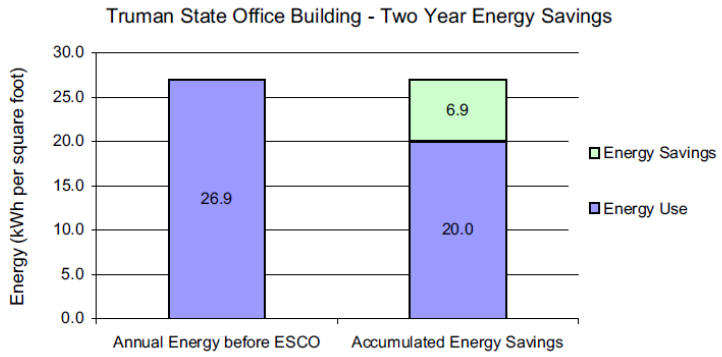
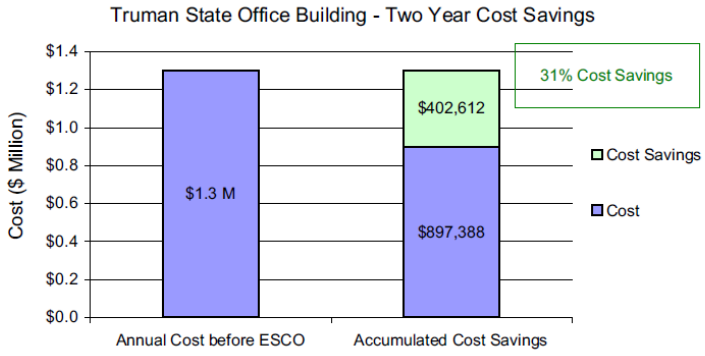



*Chart 2 – Truman State Office Building cost savings after two years*



## PILOT 2

Wainwright Office Building, Downtown St. Louis, Missouri

234,000 square feet

40 percent energy savings after two years

In the base line year (the year before the ESCO), annual energy consumption for Wainwright office building was 33 Kilowatt hours per square foot or $620.301 in total energy costs. Two years after ESCO, the annual energy consumption dropped to 19.7 Kilowatt hours per square foot and saved $250,000 in energy costs, which was $45,000 more than the guaranteed savings.

*Chart 3 – Wainwright Office Building reduction in energy savings after two years*

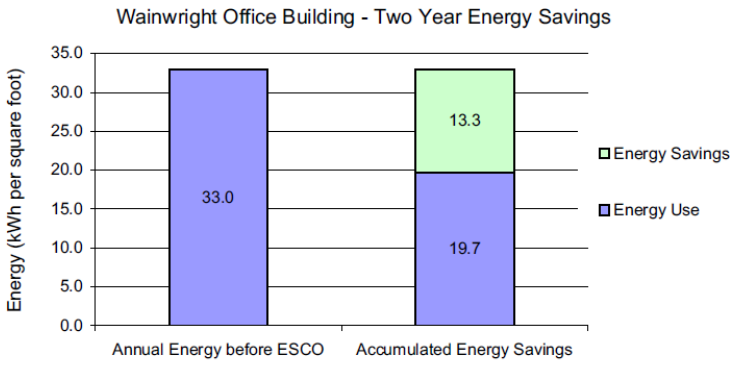
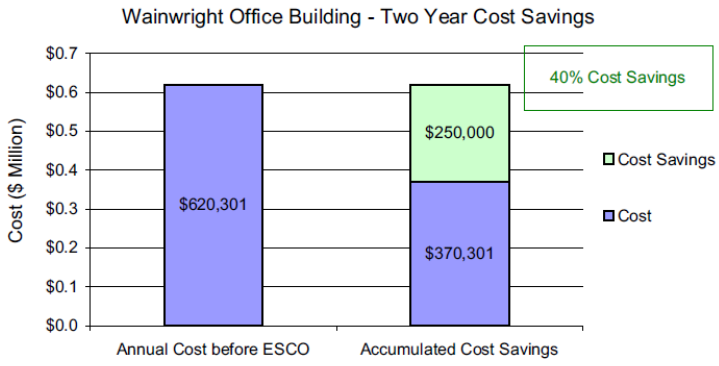



*Chart 4 – Wainwright Office Building cost savings after two years*



These technologies, in conjunction with some traditional energy conservation measures, have resulted in more savings than expected. The integrated solution approach enabled the State of Missouri to reduce energy and maintenance costs by as much as 40 percent with a payback period of less than two years.

The project was started in December of 2006 and was deployed through 2007. Using middleware software to connect existing building controls systems rather than replacing them enabled the project to significantly speed up the deployment time by about 30 percent to reduced the cost of implementation. The integration and interoperability features of middleware reduced the time for completion from three to four years to one to two years, and provided the data feed that allowed some of the other partners on the team to perform their jobs. As the traditional building automation systems were closed systems, using middleware enabled the content and interaction of building systems to move to the network and remove significant cost barriers to access the proprietary and legacy data from all the different systems that measure, monitor, and consume energy within a facility.

With one unified approach to monitoring facilities, the State can change the underlying infrastructure without changing the enterprise level reporting mechanisms. This allows the State of Missouri to have a heterogeneous infrastructure that creates more competition between vendors, begins to generate savings more quickly, and achieved an ROI payback in one year rather than over the course of a decade.

## FUTURE OPPORTUNITIES/COMMISSIONING

The aim was to integrate all these systems into an intelligent system that can provide operational excellence as well as ease in maintaining the functionality of individual system by continuously monitoring, diagnosing, and taking preventive actions with scheduled maintenance. Integrating intelligence is not only desirable, but is becoming a mandatory requirement to provide clients the best automation solutions with the simplest connections to real-time data, Web-based data, and the real estate enterprise.

With the advent of technology in the independent systems of a building, building control feasibility will continue to develop and refine applications and implementation. Advances in networking technologies and the Internet have opened the door to a network-enabled world. Automated diagnostics supported by the latest sensors and control technologies can further lead to efficient building operation as well as to an increased life span for the structure. As this information is also available at remote locations, there are possibilities of achieving predictive fault detection, timely diagnosis, and prognosis. This makes it possible to produce an Intelligent Building, which provides virtual control of every system from a central location.

# 2010 Energy Report – Appendix 6
# State of Maryland Utility Bill Project

**DGS Utility Bill**

BITHGROUP won a coveted contract with the State of Maryland to provide energy management services that will facilitate better management of the State's energy resources more accurately and efficiently. Maryland is committed to reducing state government energy consumption 15% by 2015. To do that, Maryland's Department of General Services hired BITHGROUP Technologies to create and implement a statewide utility database that tracks energy performance for all state facilities. This centralized energy management system compiles comprehensive energy consumption and cost data for 55 different agencies in the State of Maryland. The objectives of this ongoing engagement include the following mandates:

- Provide efficiently manage energy resources for State agencies and the University System of Maryland
- Accurately compile energy cost and consumption data
- Host and manage online energy and utility bill processing
- Provide timely and accurate data reporting for the Governor, General Assembly and agencies
- Support de-regulated procurement activities, and energy efficiency initiatives
- Wide area network engineering
- Identify opportunities to reduce the budget deficit for the State of Maryland

State agencies, including the University System of Maryland, collectively have approximately 15,000 electric and gas accounts, and others including fuel oil, propane, and district stream. Currently, approximately 17 energy providers serve state facilities, including regulated utilities, regional cooperatives and de-regulated suppliers.

Through our comprehensive suite of services, BITHGROUP is also currently enhancing business processes for the State of Maryland that will ultimately lead to energy reduction goals as set forth by Governor Martin O'Malley in the EmPOWER Maryland initiative introduced on July 2, 2007.

The DGS project is one of the reasons Maryland was ranked the 12th most energy-efficient state by The American Council for an Energy Efficient Economy. They named Maryland as one of the most improved states, moving from 20th place in 2006 to 12th in 2008.